MP-10

HTH [illegible]

PRICE $2.00

HEATH COMPANY • BENTON HARBOR, MICHIGAN

HEATHKIT®
ASSEMBLY MANUAL

HEATHKIT® by DAYSTROM

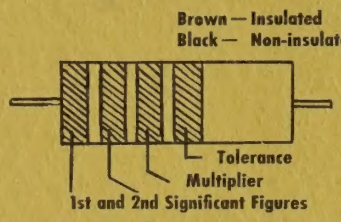
POWER CONVERTER

MODEL MP-10

STANDARD COLOR CODE — RESISTORS AND CAPACITORS

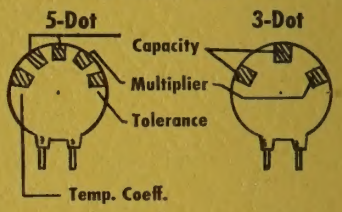
INSULATED UNINSULATED Color	FIRST RING BODY COLOR First Figure	SECOND RING END COLOR Second Figure	THIRD RING DOT COLOR Multiplier
BLACK	0	0	None
BROWN	1	1	0
RED	2	2	00
ORANGE	3	3	,000
YELLOW	4	4	0,000
GREEN	5	5	00,000
BLUE	6	6	000,000
VIOLET	7	7	0,000,000
GRAY	8	8	00,000,000
WHITE	9	9	000,000,000

AXIAL LEAD RESISTOR

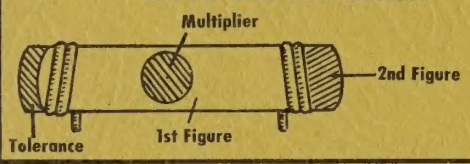


Wire wound resistors have 1st digit band double width

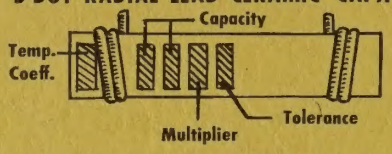
DISC CERAMIC RMA CODE



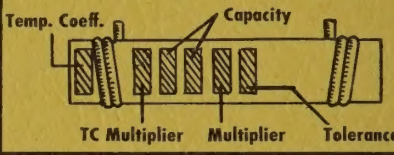
RADIAL LEAD DOT RESISTOR



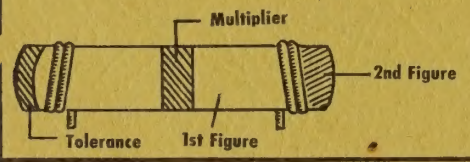
5-DOT RADIAL LEAD CERAMIC CAPACITOR



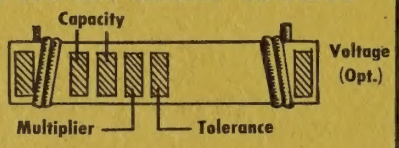
EXTENDED RANGE TC CERAMIC HICAP



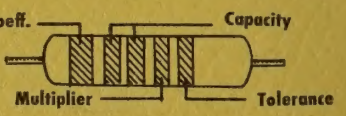
RADIAL LEAD (BAND) RESISTOR



BY-PASS COUPLING CERAMIC CAPACITOR



AXIAL LEAD CERAMIC CAPACITOR

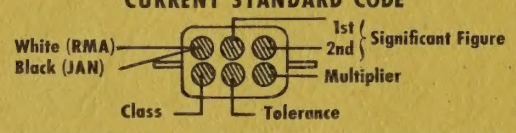


The standard color code provides all necessary information required to properly identify color coded resistors and capacitors. Refer to the color code for numerical values and the zeroes or multipliers assigned to the colors used. A fourth color band on resistors determines tolerance rating as follows: Gold = 5%, silver = 10%. Absence of the fourth band indicates a 20% tolerance rating.

The physical size of carbon resistors is determined by their wattage rating. Carbon resistors most commonly used in Heathkits are ½ watt. Higher wattage rated resistors when specified are progressively larger in physical size. Small wire wound resistors ½ watt, 1 or 2 watt may be color coded but the first band will be double width.

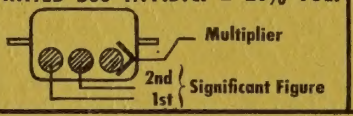
MOLDED MICA TYPE CAPACITORS

CURRENT STANDARD CODE



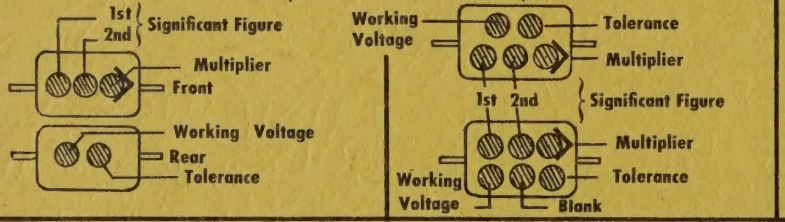
JAN & 1948 RMA CODE

RMA 3-DOT (OBSOLETE) RATED 500 W.V.D.C. ± 20% TOL.

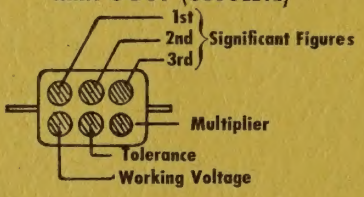


BUTTON SILVER MICA CAPACITOR

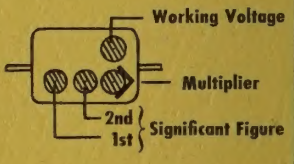
RMA (5-DOT OBSOLETE CODE)



RMA 6-DOT (OBSOLETE)

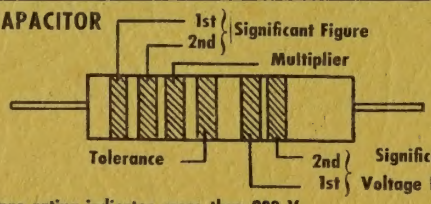


RMA 4-DOT (OBSOLETE)



MOLDED PAPER TYPE CAPACITORS

TUBULAR CAPACITOR

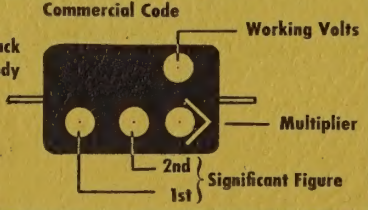


Normally stamped for value

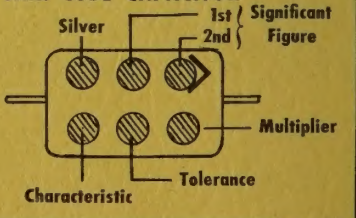
A 2 digit voltage rating indicates more than 900 V. Add 2 zeros to end of 2 digit number.

MOLDED FLAT CAPACITOR

Commercial Code



JAN. CODE CAPACITOR



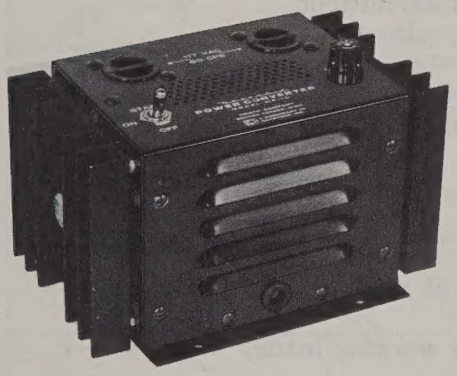
The tolerance rating of capacitors is determined by the color code. For example: red = 2%, green = 5%, etc. The voltage rating of capacitors is obtained by multiplying the color value by 100. For example: orange = 3 × 100 or 300 volts. Blue = 6 × 100 or 600 volts.

In the design of Heathkits, the temperature coefficient of ceramic or mica capacitors is not generally a critical factor and therefore Heathkit manuals avoid reference to temperature coefficient specifications.

Courtesy of Centralab

Assembly and Operation of the HEATHKIT® POWER CONVERTER

MODEL MP-10



HEATH COMPANY,
BENTON HARBOR,
MICHIGAN

a subsidiary of
DAYSTROM, INCORPORATED

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All prices are subject to change without notice. The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

8/11/61

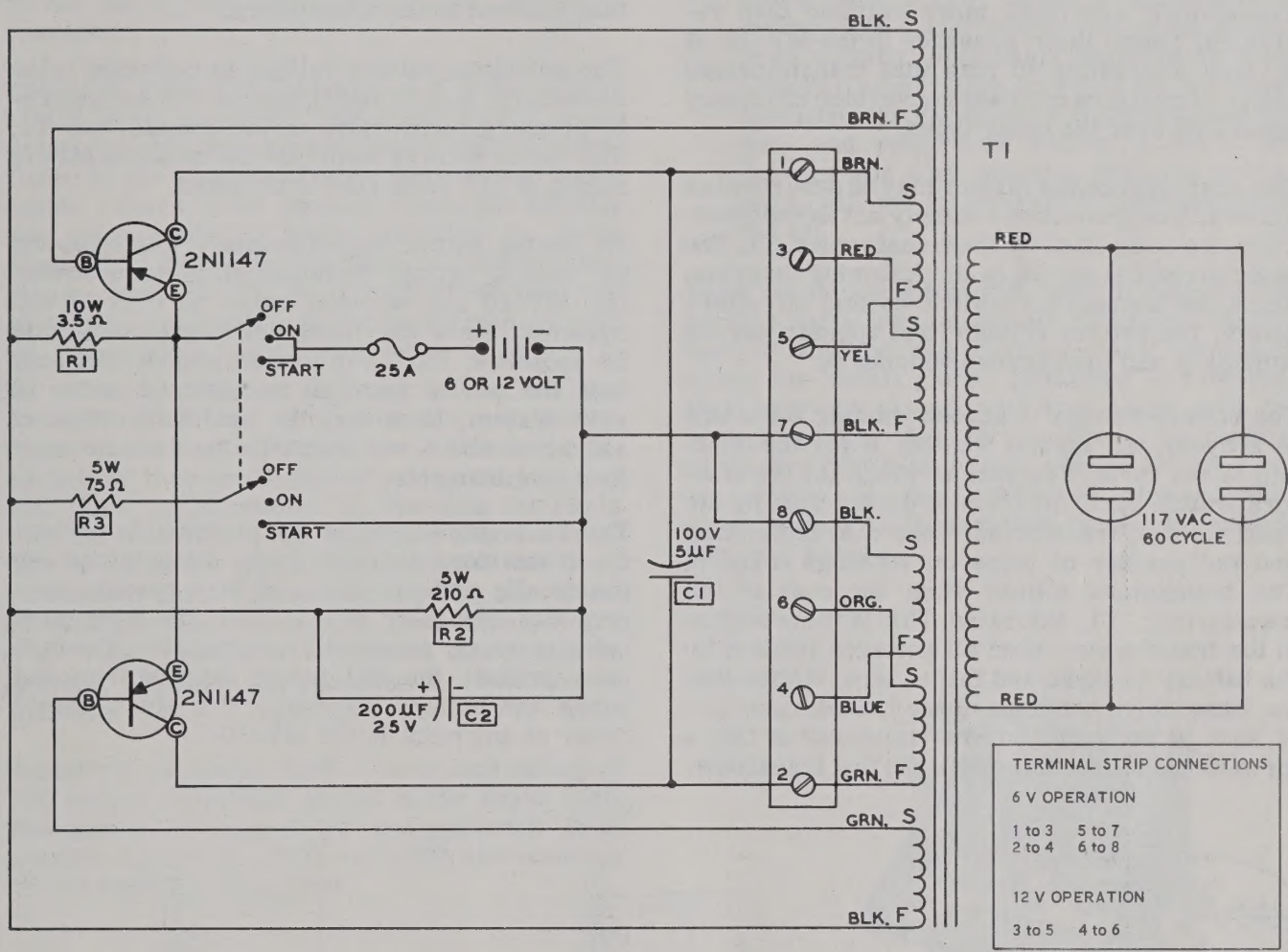
SPECIFICATIONS

Power Source:	Nominal 6 or 12 volt storage battery.
Current Input:	12 volt operation - 16.5 amperes for 175 watts output. 6 volt operation - 25 amperes for 120 watts output.
Unloaded Power Input:	Approximately 18 watts.
Input Terminals:	Wingnuts on underside of MP-10.
Power Output:	Nominal - 117 volts AC, 60 cps; essentially a square waveform. 12 volt operation - 240 watts intermittent. 175 watts continuous. 6 volt operation - 120 watts intermittent and continuous. (See Output Power vs. Temperature curve on Page 27.)
Output Terminals:	Two standard 125 volt AC receptacles.
Efficiency:	80% over usual working loads. (See efficiency curve on Page 28.)
External Load:	Any that will not cause the MP-10 to exceed 25 ampere input current.
Controls:	OFF-ON-START switch.
Protection:	25 ampere fuse.
Transistors:	2 - 2N1147 power type.
Overall Size:	7-3/8" long, 5-1/8" wide, 4-3/4" high.
Net Weight:	6-1/2 lbs.
Shipping Weight:	7-1/2 lbs.

INTRODUCTION

The HEATHKIT® Model MP-10 Power Converter changes direct current (DC) into 60 cycle alternating current (AC). In other words, the MP-10 makes the equivalent of electric house power available from a 6 or 12 volt storage battery.

The electrical operation of the MP-10 involves no moving parts. This results in a long service life. Also, the MP-10 will handle almost any type of load, within its rated power output capabilities, in a satisfactory manner.



POWER CONVERTER
MODEL MP-10

CIRCUIT DESCRIPTION

With the introduction of transistors about 10 years ago, it became possible to create a new type of DC to AC power converter. Older types of power converters use rotating machines and mechanical vibrators to perform the switching function. The transistorized power converter closely resembles the vibrator type converter but the transistors do the work of the vibrator. Transistors are much more reliable than vibrators, hence their presence in the MP-10. It is also interesting to note that transistorized power converters increase conversion efficiency about 20% over the older types.

The operation of the circuit may be described as follows. The transistors simply act as switches. They are controlled by the transformer, T1. The basic circuit is shown in the following diagram. Since the transistors switch on and off alternately, the battery voltage first appears across winding A and then across winding B.

The battery voltage is across winding A for half of a cycle and across winding B for the other half of the cycle. The rate at which the transistors switch back and forth is determined by the input voltage, transformer core characteristics and the number of turns on windings A and B. The transistors switch when the core of the transformer, T1, saturates. This is the condition in the transformer when all voltages induced by the battery collapse and fall to zero. Notice that the base drive windings of the transformer are of such polarity that when a transistor is ON, a forward bias current is applied to that transistor.

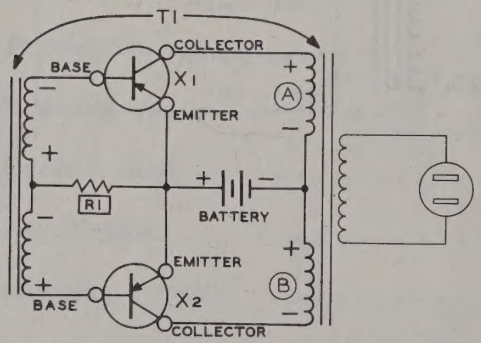
The base drive current is limited by resistor R1 to a safe value, yet enough to switch up to 25 amperes through the transistors.

Capacitors C1 and C2 eliminate voltage transients that would damage the transistors. Resistors R2 and R3 enable the unit to start properly under load by providing a small forward bias current to the transistors.

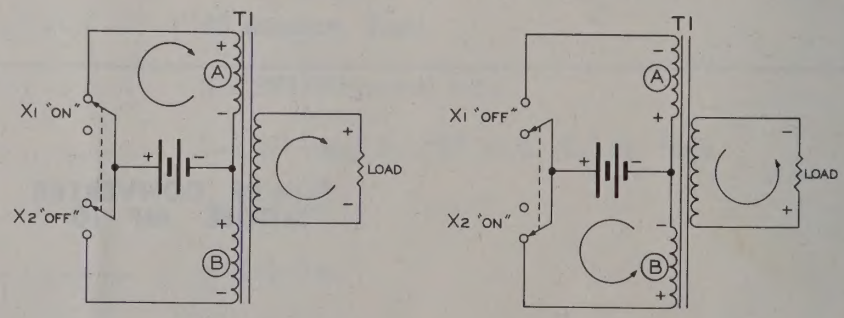
The switching battery voltage is reflected to the secondary, and is multiplied by the secondary-to-primary turns ratio of the transformer T1. The turns ratio is such that the nominal MP-10 rating of 117 volts rms is obtained.

By having center tapped primary windings, and by making proper terminal strip connections, the MP-10 can be used either in 6 or 12 volt systems. Since the maximum input current is 25 amperes, the 6 volt system can deliver only half the power that can be realized in the 12 volt system. However, the available output of 120 watts with 6 volt operation will handle most load requirements.

The 25 ampere fuse is not provided to protect the transistors from failures. Transistors are practically indestructible if they operate in a properly designed circuit with the equipment being properly connected and operated. The fuse does protect the DC power source from hot wires and battery discharge if a short should occur at any point in the MP-10.



BASIC CIRCUIT



TRANSISTORS AS SWITCHES

CONSTRUCTION NOTES

This manual is supplied to assist you in every way to complete your kit with the least possible chance for error. The arrangement shown is the result of extensive experimentation and trial. If followed carefully, the result will be a stable instrument, operating at a high degree of dependability. We suggest that you retain the manual in your files for future reference, both in the use of the instrument and for its maintenance.

UNPACK THE KIT CAREFULLY AND CHECK EACH PART AGAINST THE PARTS LIST. In so doing, you will become acquainted with the parts. Refer to the charts and other information on the inside covers of the manual to help you identify the components. If some shortage or parts damage is found in checking the Parts List, please read the REPLACEMENT section and supply the information called for therein. Include all inspection slips in your letter to us.

In order to expedite delivery to you, we are occasionally forced to make minor substitution of parts. Such substitutions are carefully checked before they are approved and parts supplied will work satisfactorily. In checking the Parts List for resistors, for example, you may find that a resistor with a 5% tolerance has been substituted for a resistor with a 10% tolerance, as shown in the Parts List. These changes are self-evident and are mentioned here only to prevent confusion in checking the contents of your kit.

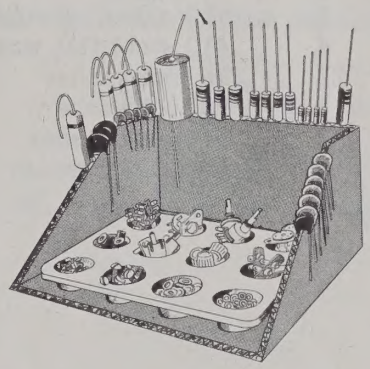
Resistors generally have a tolerance rating of 10% unless otherwise stated in the Parts List. Tolerances on capacitors are generally even greater. Limits of +100% and -50% are common for electrolytic capacitors.

We suggest that you do the following before work is started:

1. Lay out all parts so that they are readily available.

2. Provide yourself with good quality tools. Basic tool requirements consist of a screwdriver with a 1/4" blade; a small screwdriver with a 1/8" blade; long-nose pliers; wire cutters, preferably separate diagonal cutters; a pen knife or a tool for stripping insulation from wires; a soldering iron (or gun) and rosin core solder. A set of nut drivers and a nut starter, while not necessary, will aid extensively in construction of the kit.

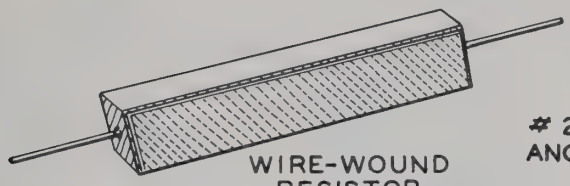
Most kit builders find it helpful to separate the various parts into convenient categories. Muffin tins or molded egg cartons make convenient trays for small parts. Resistors and capacitors may be placed with their lead ends inserted in the edge of a piece of corrugated cardboard until they are needed. Values can be written on the cardboard next to each component. The illustration shows one method that may be used.



PARTS LIST

PART No.	PARTS Per Kit	DESCRIPTION
Resistors-Capacitors		
3E-5	1	210 Ω 5 watt wire-wound resistor
3E-15	1	75 Ω 5 watt wire-wound resistor
3J-20	1	3.5 Ω 10 watt wire-wound resistor
25-75	1	5 μfd 100 volt non-polarized electrolytic capacitor
25-104	1	200 μfd 25 volt electrolytic capacitor
Hardware		
204-9	10	Angle bracket
250-26	8	6-32 x 5/8" screw
250-35	4	#8 x 7/8" sheet metal screw
250-48	4	6-32 x 1/2" screw
250-84	2	8-32 special stud screw
250-89	4	6-32 x 3/8" screw
250-116	28	6-32 x 1/4" screw (black)
250-137	4	8-32 x 3/8" screw
250-152	2	10-24 x 3/4" screw
252-3	42	6-32 x 1/4" nut
252-28	2	8-32 thumbnut
252-30	2	10-24 nut
252-31	2	10-24 wingnut
253-2	4	#6 fiber shoulder washer
253-3	2	#10 fiber flat washer
253-7	2	#10 fiber shoulder washer
253-42	4	#10 steel flat washer
254-1	22	#6 lockwasher
254-2	4	#8 lockwasher
254-3	2	#10 lockwasher
255-1	8	#6 x 1/8" spacer

PART No.	PARTS Per Kit	DESCRIPITION
Hardware (cont'd.)		
255-37	4	3/8" dia. x 3/4" long 8-32 threaded spacer
259-1	2	#6 solder lug
259-5	2	#10 solder lug
259-11	8	#6 spade lug
259-15	4	#8 terminal lug
Metal Parts		
215-M2F	2	Heat sink
200-M257F343	1	Chassis
201-M24F342	1	Chassis base
Miscellaneous		
54-100	1	Transformer
61-11	1	Switch
73-3	1	1/2" rubber grommet
75-43	2	Insulator plate (black)
344-2	1	Length #18 stranded hookup wire
346-1	1	Length sleeving
346-2	1	Length clear plastic sleeving
417-29	2	2N1147 transistor
421-14	2	25 ampere fuse (one spare)
423-2	1	Fuse holder
431-13	2	4-lug terminal strip screw type
431-15	2	1-lug terminal strip
431-50	1	1-lug terminal strip
431-51	1	2-lug terminal strip
434-106	2	AC socket
490-4	1	Drill bit, #28
595-328	1	Manual



WIRE-WOUND RESISTOR

#204-9
ANGLE BRACKET

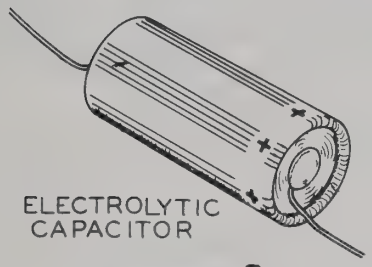
#254-1
#6 LOCKWASHER

*259-15
#8 TERMINAL LUG

#252-3
6-32 NUT

#254-2
#8 LOCKWASHER

*259-11
#6 SPADE LUG



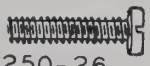
ELECTROLYTIC CAPACITOR

*252-28
THUMB NUT

*254-3
#10 LOCKWASHER

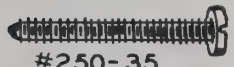
#255-1
1/8" ALUMINUM SPACER

*73-3
1/2" RUBBER GROMMET



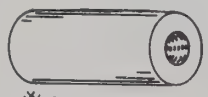
#250-26
6-32 x 5/8"

*252-30
10-24 NUT



#250-35
8 X 7/8" SHEET METAL SCREW

10-24
WING NUT



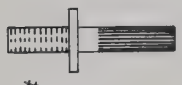
*255-37
3/8" DIA. X 3/4" LONG
8-32 THREADED SPACER

#250-48
6-32 X 1/2"

*250-89
6-32 X 3/8"

#253-2
#6 SHOULDER FIBER WASHER

#253-7
#10 FIBER SHOULDER WASHER

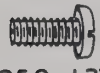


*250-84
8-32 SPECIAL STUD SCREW

*253-42
*10 STEEL FLAT WASHER

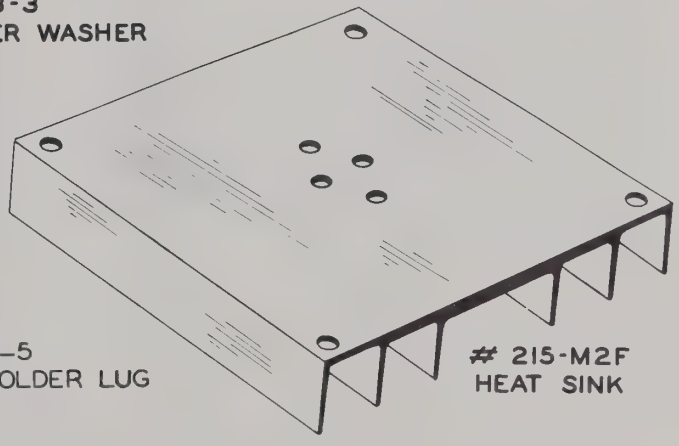
*250-116
6-32 x 1/4
(BLACK)

#253-3
#10 FLAT FIBER WASHER



*250-137
8-32 x 3/8

#259-1
#6 SOLDER LUG



#215-M2F
HEAT SINK

#250-152
10-24 X 3/4"

#259-5
#10 SOLDER LUG

PROPER SOLDERING TECHNIQUES

Only a small percentage of HEATHKIT® equipment purchasers find it necessary to return an instrument for factory service. Of these instruments, by far the largest portion malfunction due to poor or improper soldering.

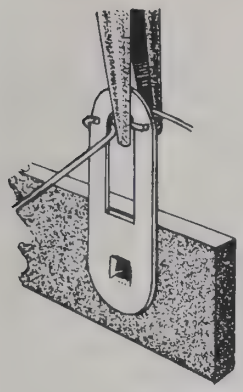
If terminals are bright and clean and free of wax, frayed insulation and other foreign substances, no difficulty will be experienced in soldering. Correctly soldered connections are essential if the performance engineered into a kit is to be fully realized. If you are a beginner with no experience in soldering, a half hour's practice with some odd lengths of wire may be a worthwhile investment.

For most wiring, a 30 to 100 watt iron or its equivalent in a soldering gun is very satisfactory. A lower wattage iron than this may not heat the connection enough to flow the solder smoothly over the joint. Keep the iron tip clean and bright by wiping it from time to time with a cloth.

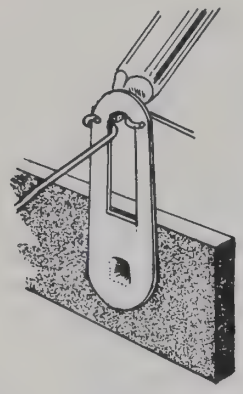
CHASSIS WIRING AND SOLDERING

1. All wire used in this kit is plastic insulated, #18 stranded (hookup) wire. In preparing a length of hookup wire, 1/4" of insulation should be removed from each end unless directed otherwise in the construction step.
2. To avoid breaking internal connections when stripping insulation from the leads of transformers or similar components, care should be taken not to pull directly on the lead. Instead, hold the lead with pliers while it is being stripped.
3. Leads on resistors, capacitors and similar components are generally much longer than they need to be to make the required connections. In these cases, the leads should be cut to proper length before the part is added to the chassis. In general, the leads should be just long enough to reach their terminating points.
4. Wherever there is a possibility of bare leads shorting to other parts or to the chassis, the leads should be covered with insulating sleeving. Where the use of sleeving is specifically intended, the phrase "use sleeving" is included in the associated construction step. In any case where there is the possibility of an unintentional short circuit, sleeving should be used. Extra sleeving is provided for this purpose.
5. Crimp or bend the lead (or leads) around the terminal to form a good joint without relying on solder for physical strength. If the wire is too large to allow bending or if the step states that the wire is not to be crimped, position the wire so that a good solder connection can still be made.
6. Position the work, if possible, so that gravity will help to keep the solder where you want it.
7. Place a flat side of the soldering iron tip against the joint to be soldered until it is heated sufficiently to melt the solder.
8. Then place the solder against the heated terminal and it will immediately flow over the joint; use only enough solder to thoroughly wet the junction. It is usually not necessary to fill the entire hole in the terminal with solder.
9. Remove the solder and then the iron from the completed junction. Use care not to move the leads until the solder is solidified.

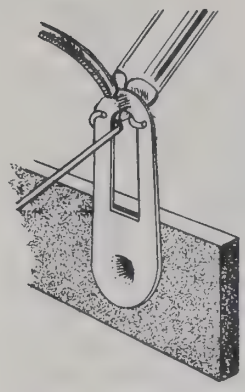
A poor or cold solder joint will usually look crystalline and have a grainy texture, or the solder will stand up in a blob and will not have adhered to the joint. Such joints should be reheated until the solder flows smoothly over the entire junction. In some cases, it may be necessary to add a little more solder to achieve a smooth bright appearance.



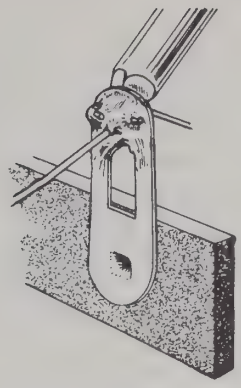
CRIMP WIRES



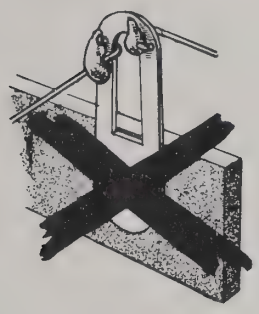
HEAT CONNECTION



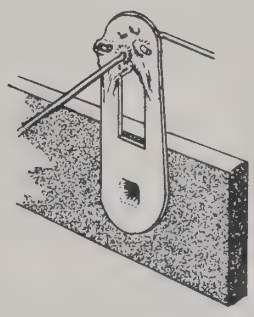
APPLY SOLDER



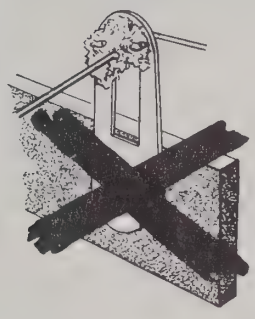
ALLOW SOLDER TO FLOW



COLD SOLDER JOINT CONNECTION INSUFFICIENTLY HEATED



PROPER SOLDER CONNECTION



COLD SOLDER JOINT CONNECTION MOVED WHILE COOLING

NOTE: ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE INSTRUMENTS IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. WHEN IN DOUBT ABOUT SOLDER, IT IS RECOMMENDED THAT A NEW ROLL PLAINLY MARKED "ROSIN CORE RADIO SOLDER" BE PURCHASED.

ASSEMBLY INSTRUCTIONS

The following instructions are presented in a logical step-by-step sequence to enable you to complete your kit with the least possible confusion. Be sure to read each step all the way through before beginning the specified operation. Also read several steps ahead of the actual step being performed. This will familiarize you with the relationship of the subsequent operations. When the step is completed, check it off in the space provided. This is particularly important as it may prevent errors or omissions, especially if your work is interrupted. Some kit builders have also found it helpful to mark each lead in colored pencil on the Pictorial as it is added.

The abbreviation "NS" indicates that a connection should not be soldered yet as other wires will be added. When the last wire is installed, the terminal should be soldered and the abbreviation "S" is used to indicate this. Note that a number will appear after each solder instruction. This number indicates the number of leads that are supposed to be connected to the terminal in point before it is soldered. For example, if the instruction reads, "Connect a lead to lug 1 (S-2)," it will be understood that there will be two leads connected to the terminal at the time it is soldered.

STEP-BY-STEP ASSEMBLY

Chassis Base Hardware Mounting

Refer to Figure 1 for the following steps.

( ) Mount the input terminal hardware at AA and BB as shown in Detail 1A. Use two 10-24 x 3/4" screws, #10 solder lugs, #10 fiber shoulder washers, #10 fiber flat washers, #10 lockwashers and 10-24 nuts.

( ) Referring to Detail 1B, mount terminal strips CC, DD, and EE. Use two 6-32 x 3/8" screws, lockwashers, and nuts.

( ) In the same manner, mount terminal strips FF, GG, and HH.

( ) Again, tighten the screws at AA and BB. This step will be repeated so that the terminals will not work loose after completion of the unit.

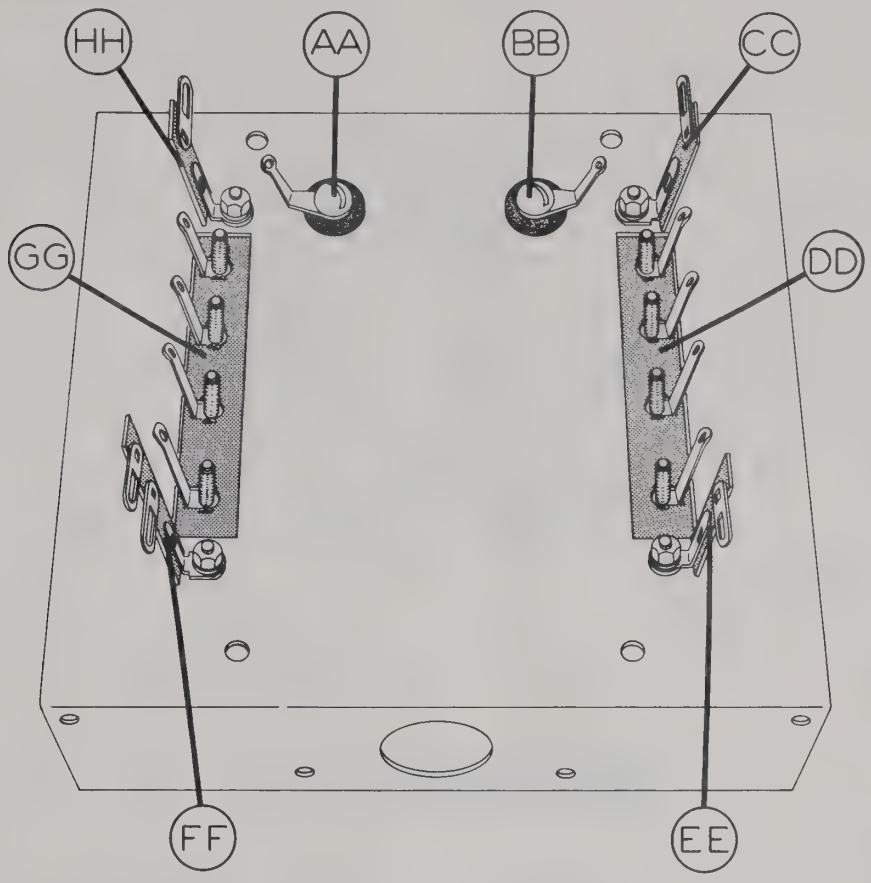
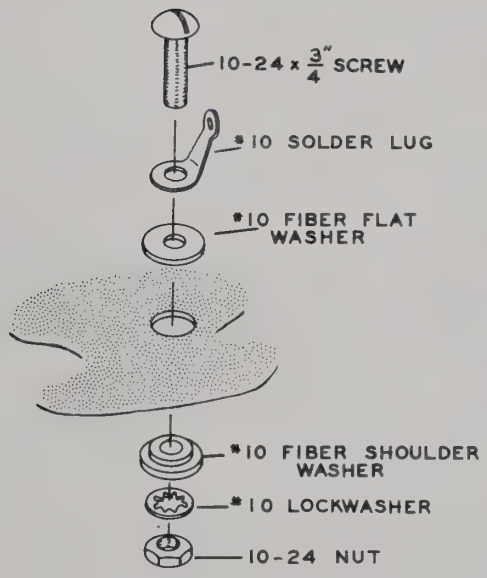
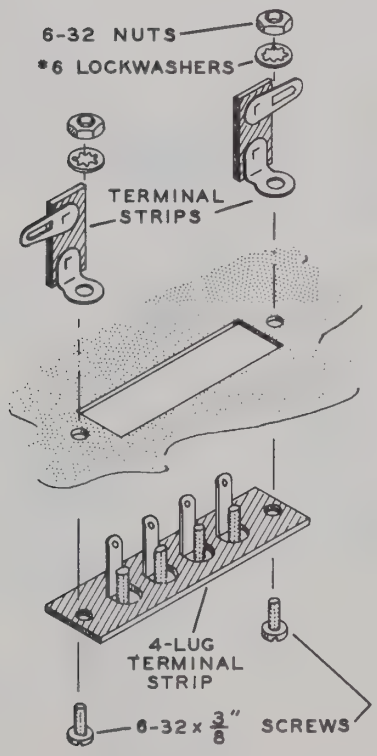


Figure 1



Detail 1A

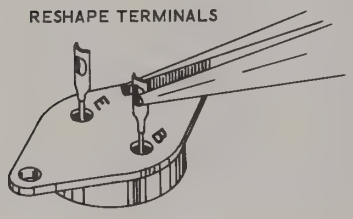


Detail 1B

Heat Sink Assembly

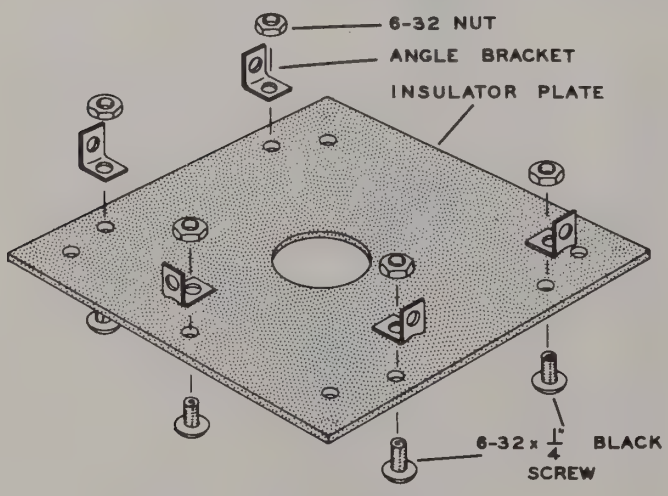
Refer to Figure 2 for the following steps.

( ) Locate the two power transistors (2N1147). If necessary, squeeze each of the transistor solder lugs together slightly so that they will pass through the mounting holes in the heat sink. Do not flatten them. See Detail 2A.



Detail 2A

( ) Mount the two transistors to the two heat sinks. Use four 6-32 x 1/2" screws, #6 fiber shoulder washers and 6-32 nuts. Also use two #6 lockwashers and #6 solder lugs. Place the solder lugs under the nuts farthest from the transistor terminals. Make sure that the transistors are flat against the heat sinks. Center the transistor terminals in the heat sink holes.



Detail 2B

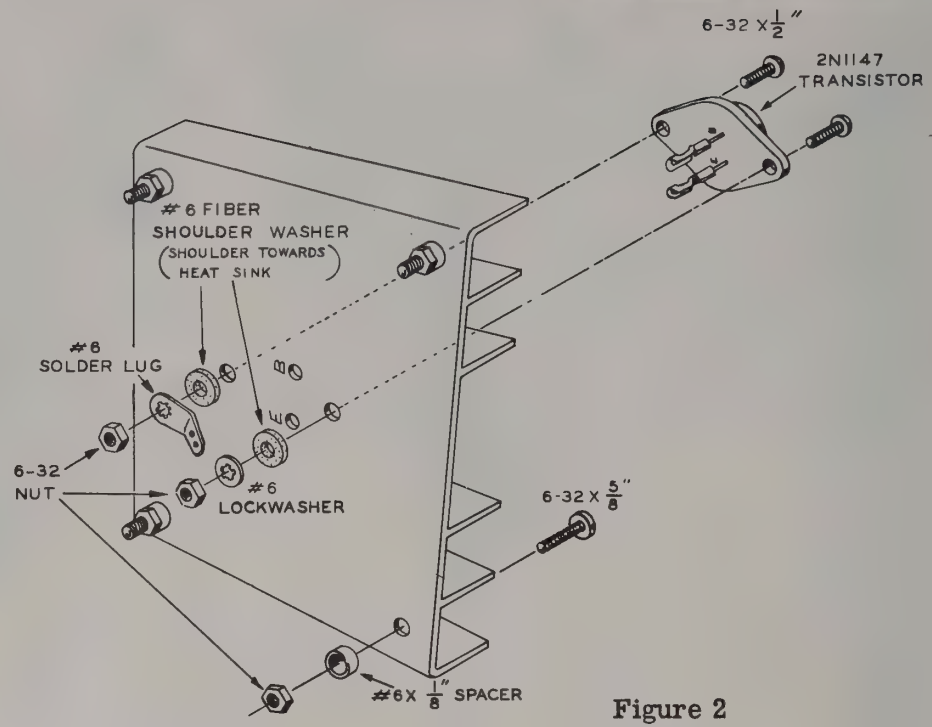


Figure 2

( ) In each corner of each heat sink, mount a 6-32 x 5/8" screw, 1/8" spacer and nut.

( ) Mount five angle brackets on each of the two insulator plates (black phenolic boards) as shown in Detail 2B. Use ten 6-32 x 1/4" black screws and ten 6-32 nuts.

Chassis Hardware Mounting

Refer to Figure 3 for the following steps.

( ) Mount the two sockets JJ and KK. Use four 6-32 x 1/4" black screws, # 6 lockwashers and 6-32 nuts. The sockets should be oriented so that the lettering on the top surfaces is "right side up" with respect to the lettering on the top of the chassis. See Detail 3A.

( ) Mount switch LL. Note the position of the switch lugs in Figure 3 and mount the switch accordingly. See Detail 3B.

( ) Mount the fuse holder MM. Bend lug 2 slightly outward after mounting. Do not overtighten the nut as the holder may crack. See Detail 3C.

( ) Again, tighten the screws at AA and BB on the chassis base (see Figure 1).

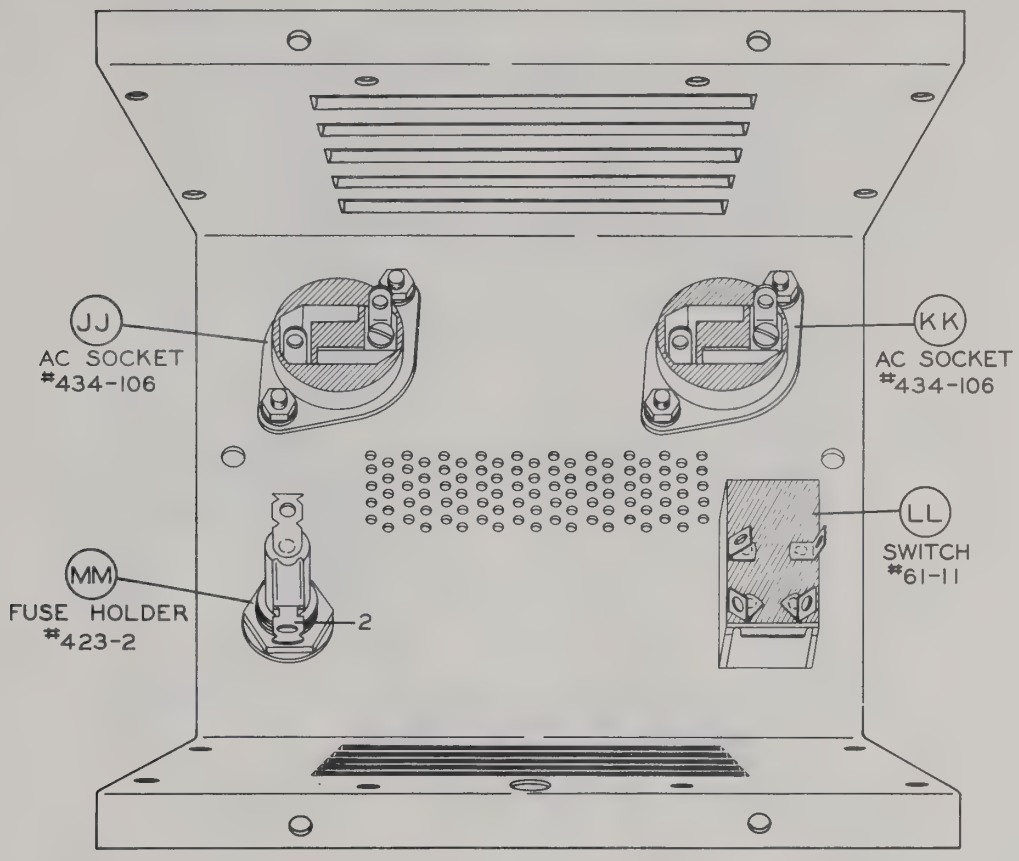
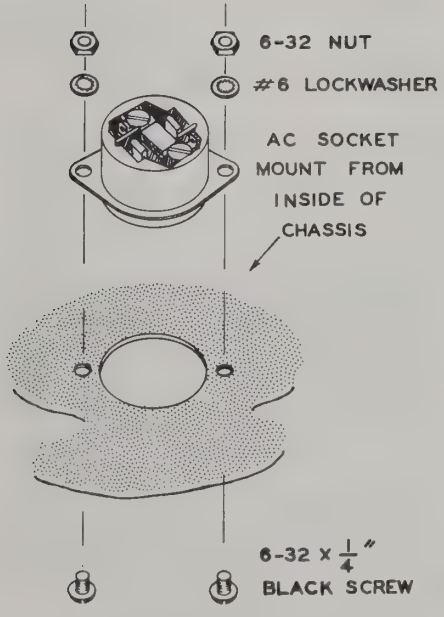
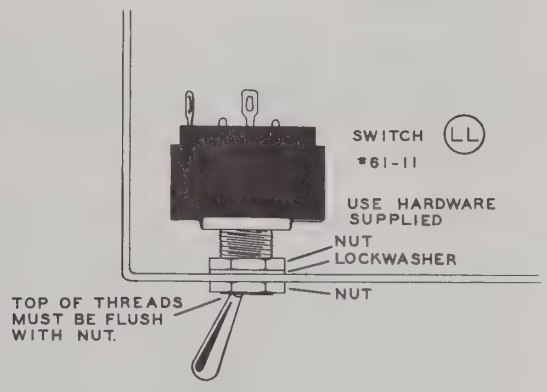


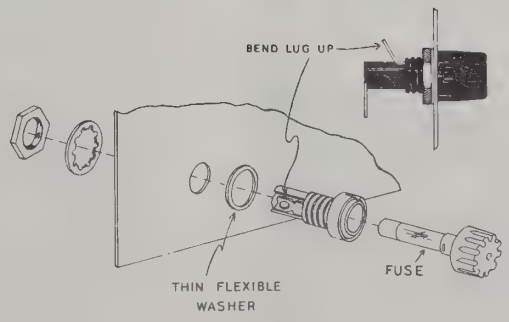
Figure 3



Detail 3A



Detail 3B



Detail 3C

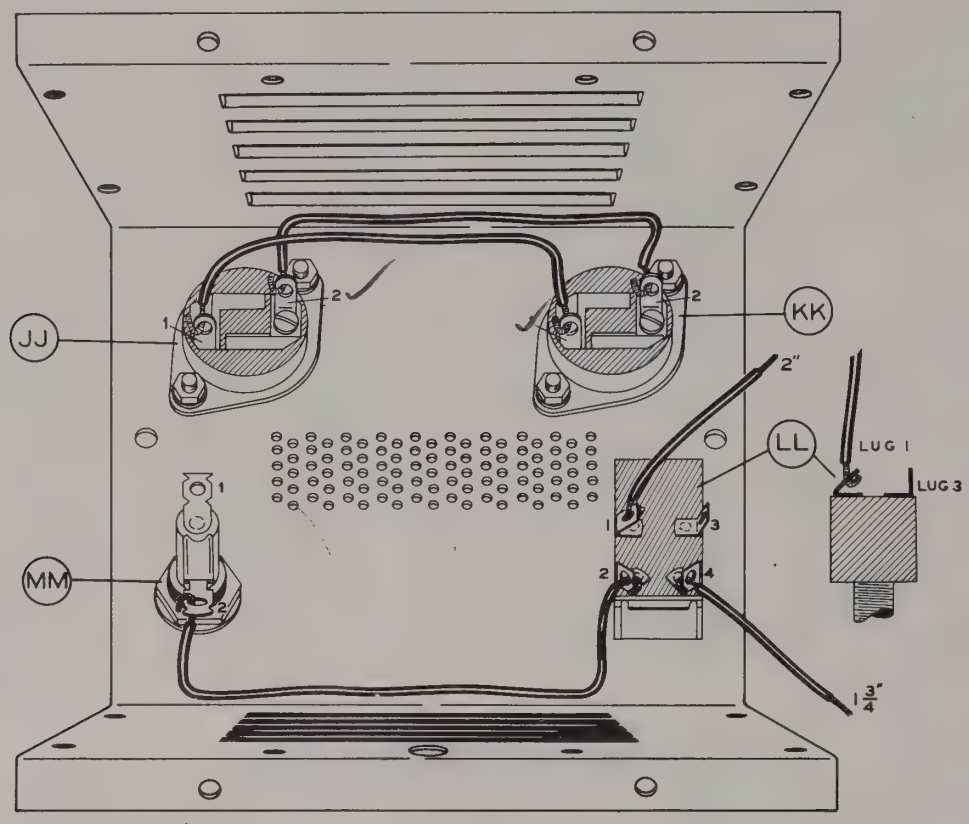


Figure 4

Chassis Wiring

NOTE: Use the #18 plastic insulated, stranded hookup wire in the following steps. When preparing a length of hookup wire, remove 1/4" of insulation from each end.

Refer to Figure 4 for the following steps.

(✓) Connect a 5-1/2" wire from lug 2 of socket JJ (S-1) to lug 2 of socket KK (NS). Dress the wire along the corner of the chassis.

(✓) Connect a 5-1/2" wire from lug 1 of socket KK (S-1) to lug 1 of socket JJ (NS). Dress as shown.

(✓) Connect a 6-1/2" wire from lug 2 of switch LL (S-1) to lug 2 of fuse holder MM (S-1). Dress the wire along the corner of the chassis.

(✓) Connect a 2" wire to lug 1 of switch LL (S-1). Bend lug 1 and make the connection as shown in the Detail next to Figure 4.

(✓) Connect a 1-3/4" wire to lug 4 of switch LL (S-1).

(✓) Recheck the wiring of this section.

Chassis Base Wiring

Refer to Figure 5 for the following steps.

(✓) Place a 1" length of sleeving over one lead of the 75 Ω resistor (#3E-15). Connect this lead to one lead of the 3.5 Ω resistor (#3J-20). Make the connection where the lead leaves the body of the 3.5 Ω resistor and solder.

(✓) Place a 1-1/4" length of sleeving over the common lead of the 3.5 Ω and 75 Ω resistors. Connect this lead to terminal strip EE (NS).

(✓) Place a 1-1/4" length of sleeving over the free lead of the 3.5 Ω resistor. Connect this lead to lug 1 of terminal strip FF (NS).

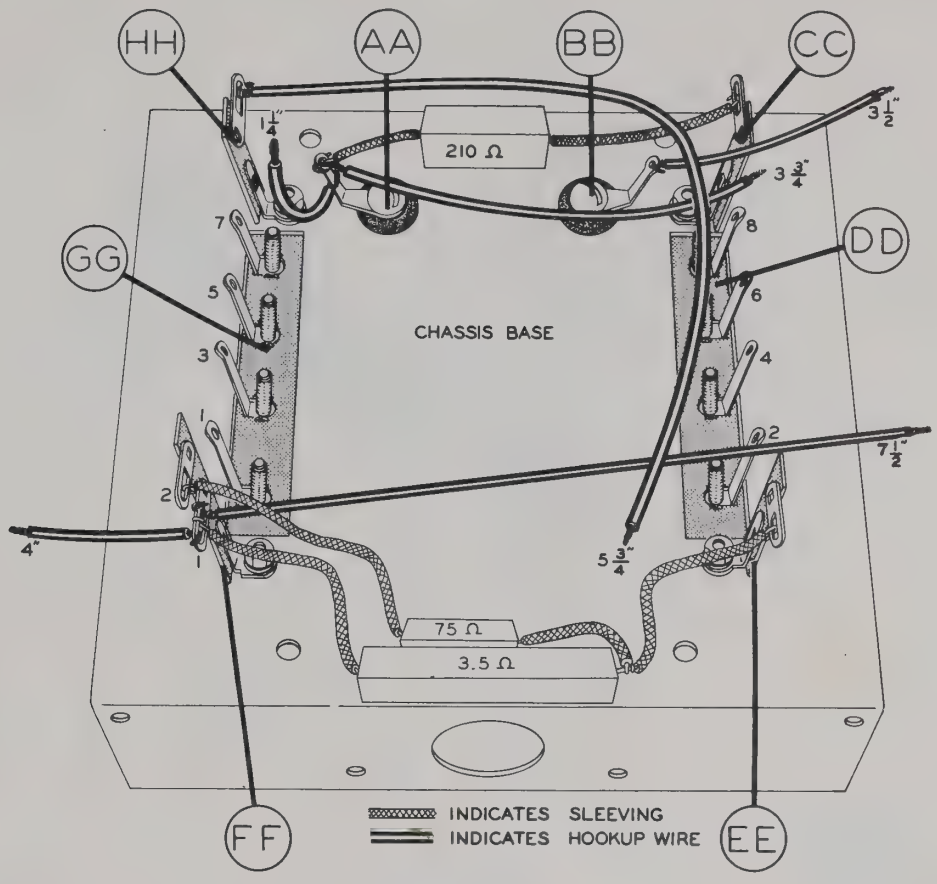


Figure 5

(✓) Connect a 4" wire to lug 1 of terminal strip FF (NS). Dress it outwards as shown.

(✓) Connect a 7-1/2" wire to lug 1 of terminal strip FF (S-3). Dress it towards terminal strip EE.

(✓) Place a 1-1/4" length of sleeving over the free lead of the 75 Ω resistor. Connect this lead to lug 2 of terminal strip FF (NS).

(✓) Connect a 3-1/2" wire to solder lug BB (S-1). Dress it over terminal strip DD.

(✓) Connect a 1-1/2" wire to solder lug AA (S-1). Wrap it around the lug just below the hole (do not use the hole or block it with solder). Dress the wire toward lug 7 of terminal strip GG.

(✓) For the last time, tighten the screws at AA and BB.

(✓) Place a 1-1/4" length of sleeving over one lead of the 210 Ω resistor (#3E-5). Connect this lead to terminal strip CC (S-1).

(✓) Place a 1" length of sleeving over the free lead of the 210 Ω resistor. Connect this lead to the hole in solder lug AA (NS).

(✓) Connect a 3-3/4" wire to the hole in solder lug AA (S-2). Dress this wire toward lug 8 of terminal strip DD.

(✓) Connect a 5-3/4" wire to terminal strip HH (NS). Dress it over the 210 Ω resistor and make a 90 degree bend at solder lug BB. Now place the end of this wire near lug 2 of terminal strip DD.

( ) Recheck the wiring in this section.

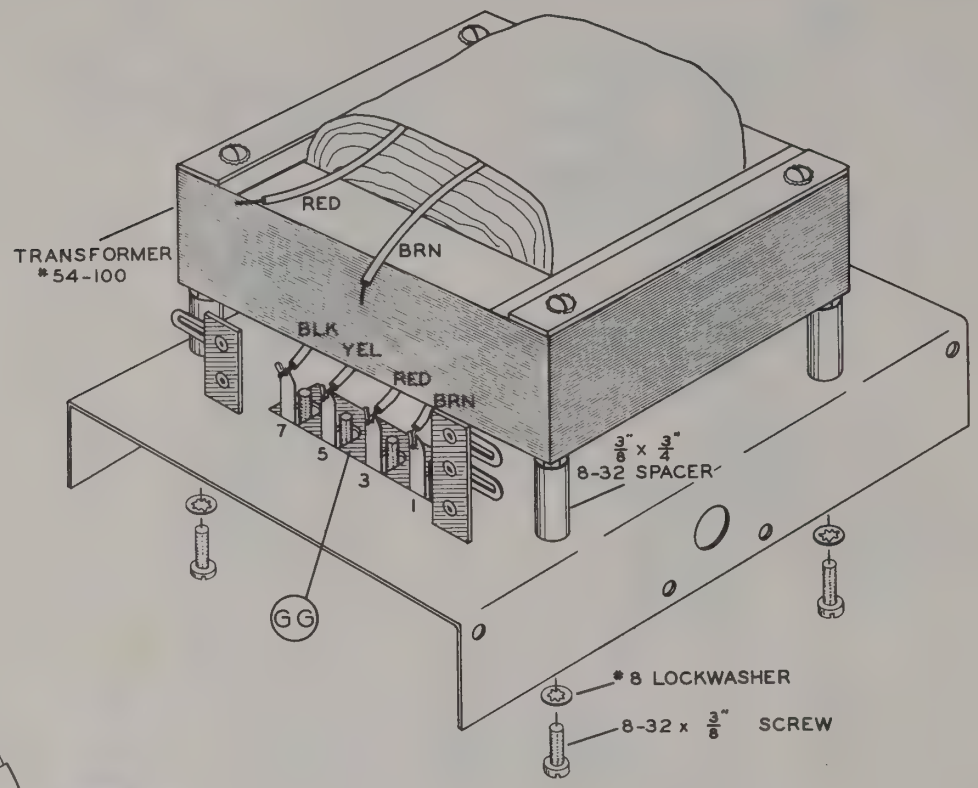
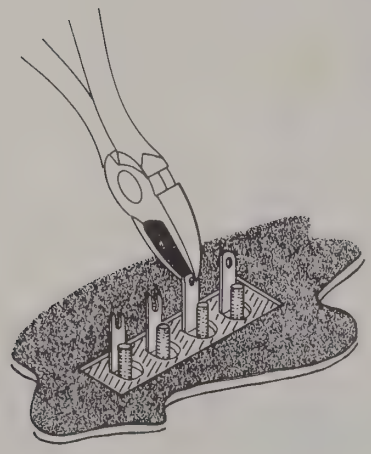


Figure 6



Detail 6A

Transformer Mounting

Refer to Figure 6 for the following steps.

(✓) Mount and tighten the four 3/8" diameter by 3/4" long threaded spacers to the four transformer bolts (#54-100). Do not remove the nuts already on the transformer.

(✓) Slot all eight solder lugs of terminal strips DD and GG. Wire cutters may be used. Be sure that the slot is wide enough to allow the heavy transformer leads to fit into the slot. See Detail 6A.

(✓) Place the transformer over the four mounting holes in the chassis base. The short brown and green leads are placed nearest the large hole in the front of the chassis base. Push any wires that might be touching the spacers slightly away. None of the wires should pass outside of the spacers. Also, keep the wire from terminal strip HH just above the short stiff transformer leads next to terminal strip DD. Now turn the transformer and chassis base over and make sure that the mounting holes line up with the spacers. Bend the spacers (bolts) slightly to make them line up if necessary. Use four 8-32 x 3/8" screws and #8 lockwashers to secure the transformer in place.

(✓) Dress all wires and resistor leads away from the spacers. Also check solder lugs AA and BB. Also make sure that the resistors are not "clamped" under the transformer. Pull them away from the transformer as far as possible.

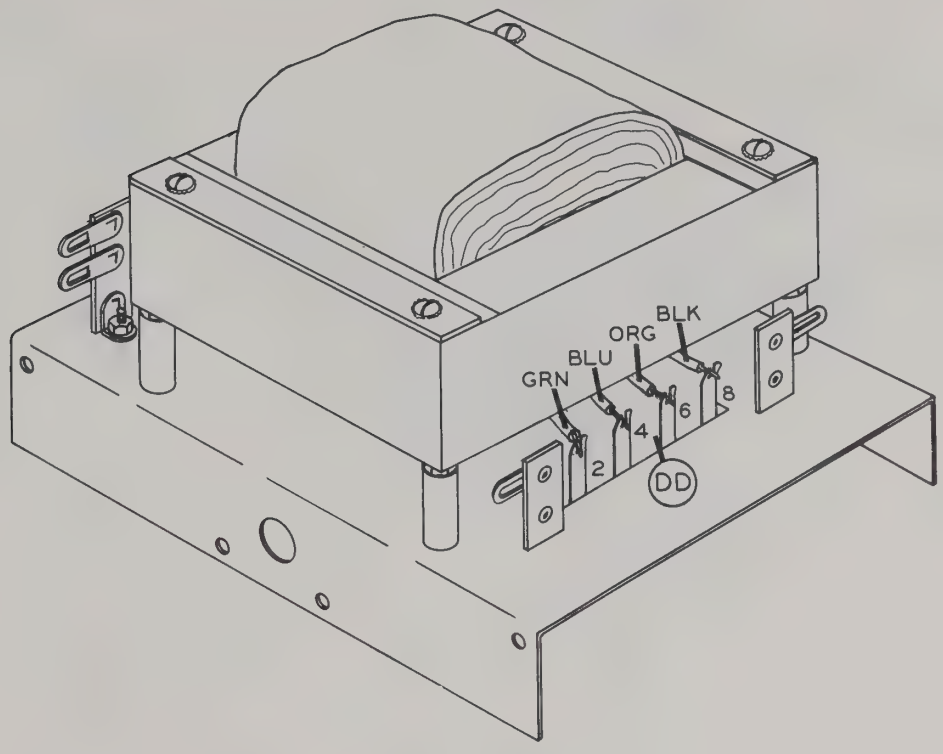


Figure 7

Final Chassis Base Wiring

Refer to Figures 6 and 7 for the following steps.

In the following eight steps, the short stiff transformer leads are connected to the 4-lug terminal strips. Do not attempt to bend the leads around the lugs. Cut off any wire extending beyond the lugs.

( ) Connect the short brown transformer lead to lug 1 of terminal strip GG (NS).

( ) Connect the short red transformer lead to lug 3 of terminal strip GG (S-1).

( ) Connect the short yellow transformer lead to lug 5 of terminal strip GG (S-1).

( ) Connect the short black transformer lead to lug 7 of terminal strip GG (NS).

( ) Connect the short green transformer lead to lug 2 of terminal strip DD (NS).

( ) Connect the short blue transformer lead to lug 4 of terminal strip DD (S-1).

( ) Connect the short orange transformer lead to lug 6 of terminal strip DD (S-1).

( ) Connect the short black transformer lead to lug 8 of terminal strip DD (NS).

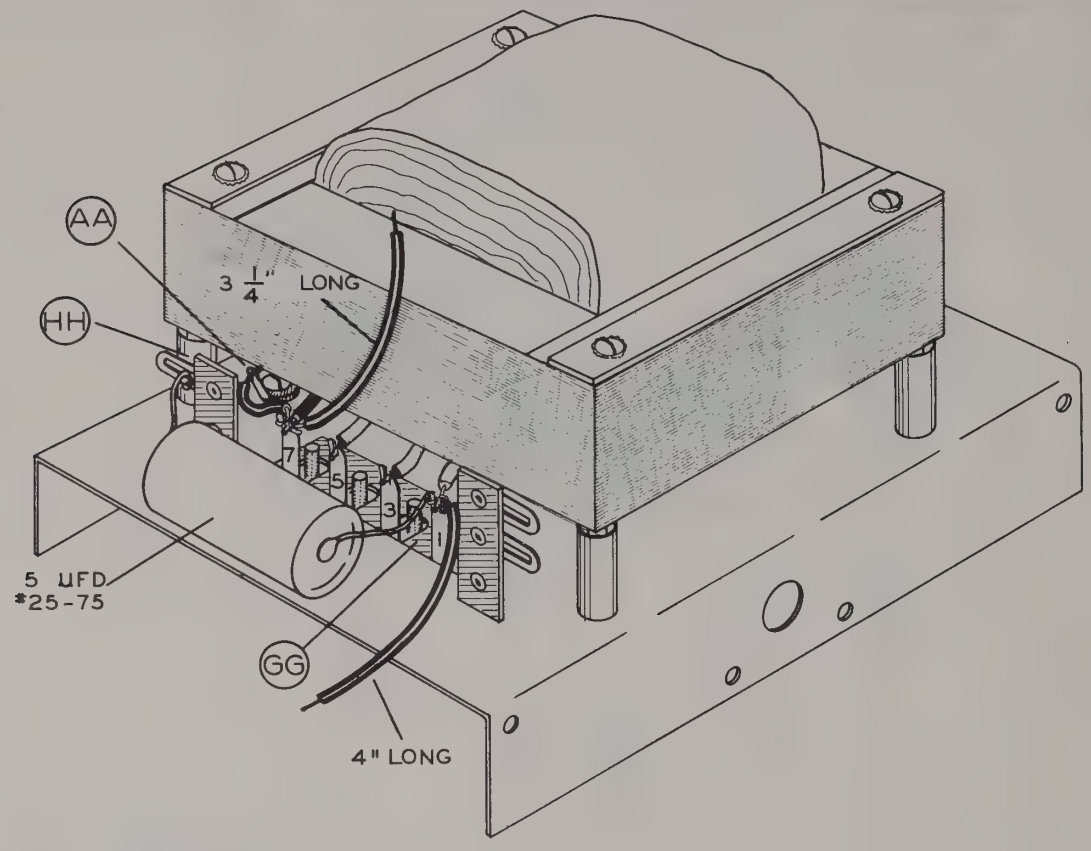


Figure 8

Refer to Figure 8 for the following steps.

(✓) Connect the short wire coming from solder lug AA to lug 7 of terminal strip GG (NS).

(✓) Connect a 3-1/4" wire to lug 7 of terminal strip GG (S-3).

(✓) Connect either lead of the 5 μfd capacitor (#25-75) to terminal strip HH (S-2).

(✓) Connect the free lead of the 5 μfd capacitor to lug 1 of terminal strip GG (NS).

( ) Connect a 4" wire to lug 1 of terminal strip GG (S-3).

Refer to Figure 9 for the following steps.

(✓) Connect the long wire coming from terminal strip HH to lug 2 of terminal strip DD (NS).

(✓) Connect a 4" wire to lug 2 of terminal strip DD (S-3).

(✓) Connect the wire coming from solder lug AA to lug 8 of terminal strip DD (NS).

(✓) Connect the negative (-) lead of the 200 μfd capacitor (#25-104) to lug 8 of terminal strip DD (S-3).

(✓) Connect the positive (+) lead of the 200 μfd capacitor to terminal strip EE (NS).

(✓) Connect a 2-3/4" wire between the upper eyelets of terminal strips CC and EE. Solder each connection.

(✓) Connect the two black leads coming from the transformer to terminal strip EE (S-4).

(✓) Recheck the wiring in this section.

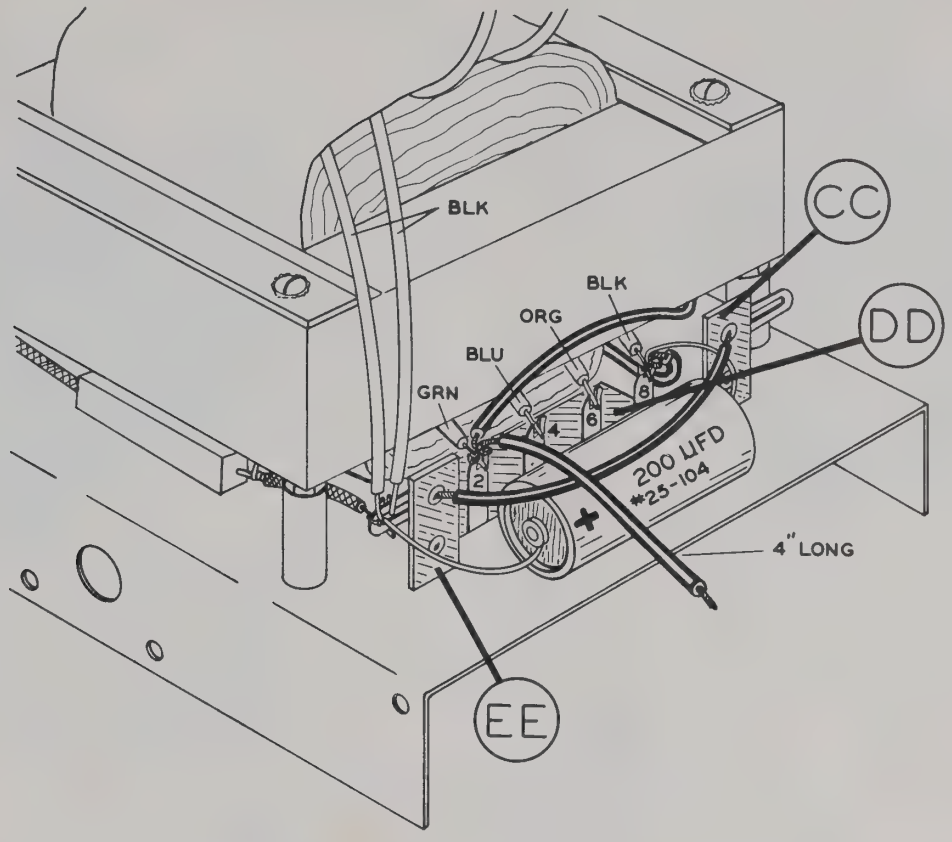


Figure 9

Refer to Figure 10 for the following step.

( ) Place the chassis assembly over the chassis base assembly. Line up the two large holes on the front. Use four 6-32 x 1/4" black screws, lockwashers and hex nuts. Use two screws on the front and two on the back in the inside holes that hold the chassis to the chassis base. Adjust the space at each end of the chassis base to equal amounts (about 1/8"). Now tighten all four screws.

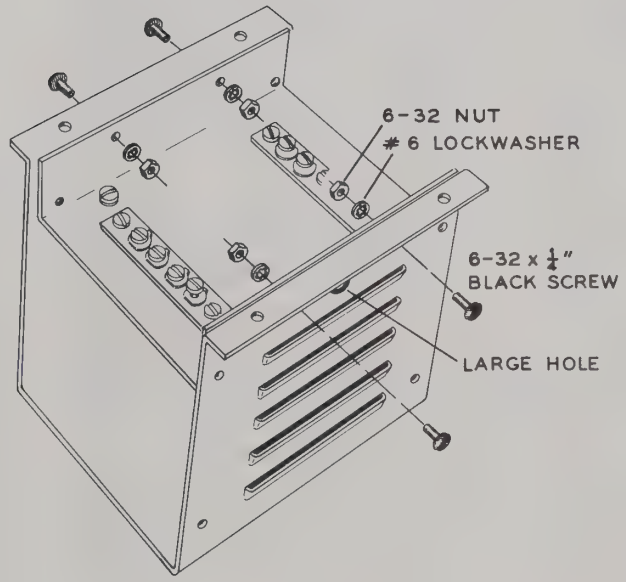


Figure 10

Refer to Figure 11 for the following steps.

(✓) Connect the red wire coming from the transformer to lug 1 of socket JJ (S-2).

(✓) Connect the wire coming from solder lug BB to lug 1 of the fuse holder MM (S-1).

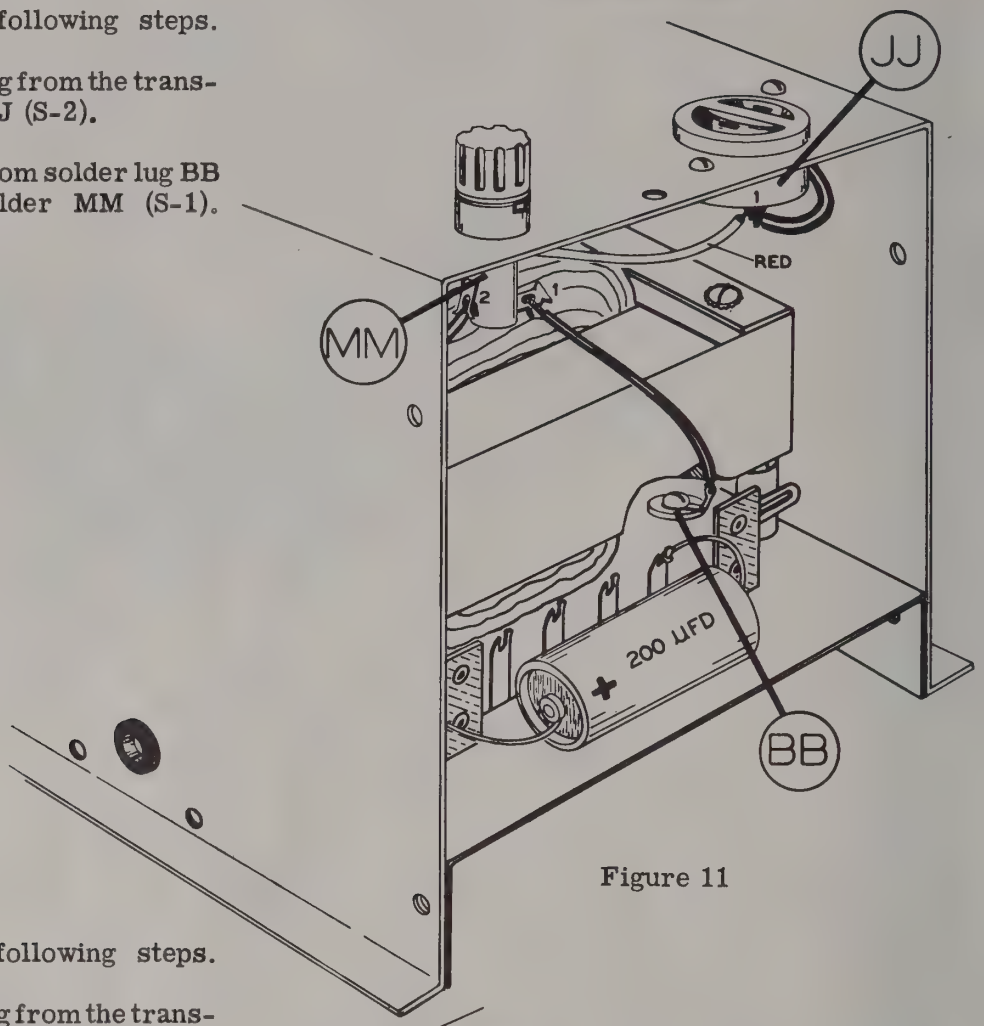


Figure 11

Refer to Figure 12 for the following steps.

(✓) Connect the red wire coming from the transformer to lug 2 of socket KK (S-2).

(✓) Connect the wire coming from lug 1 of switch LL to the eyelet of lug 1 of terminal strip FF (S-1).

(✓) Connect the wire coming from lug 4 of switch LL to lug 2 of terminal strip FF (S-2).

(✓) Connect the wire coming from lug 7 of terminal strip GG to lug 3 of switch LL (S-1).

( ) Recheck the wiring in this section.

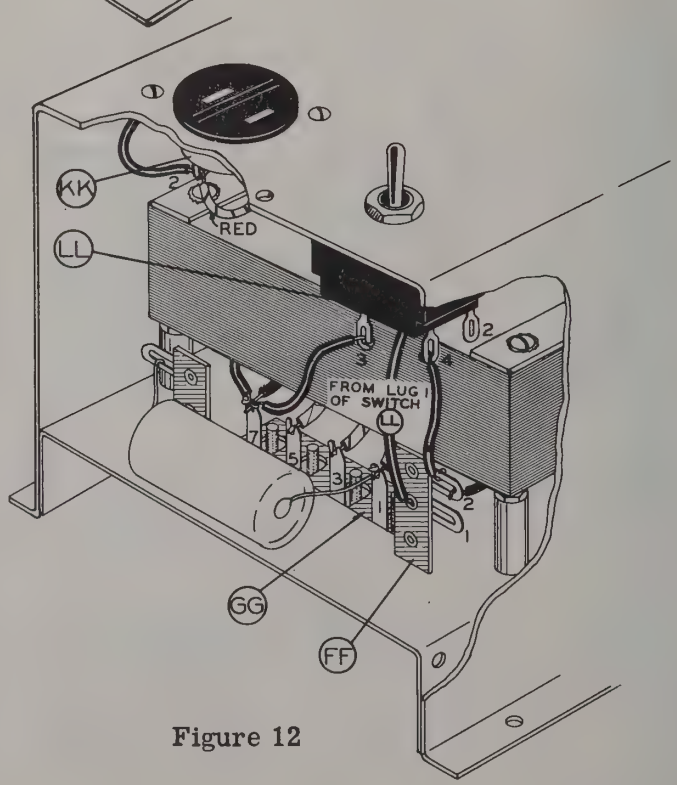


Figure 12

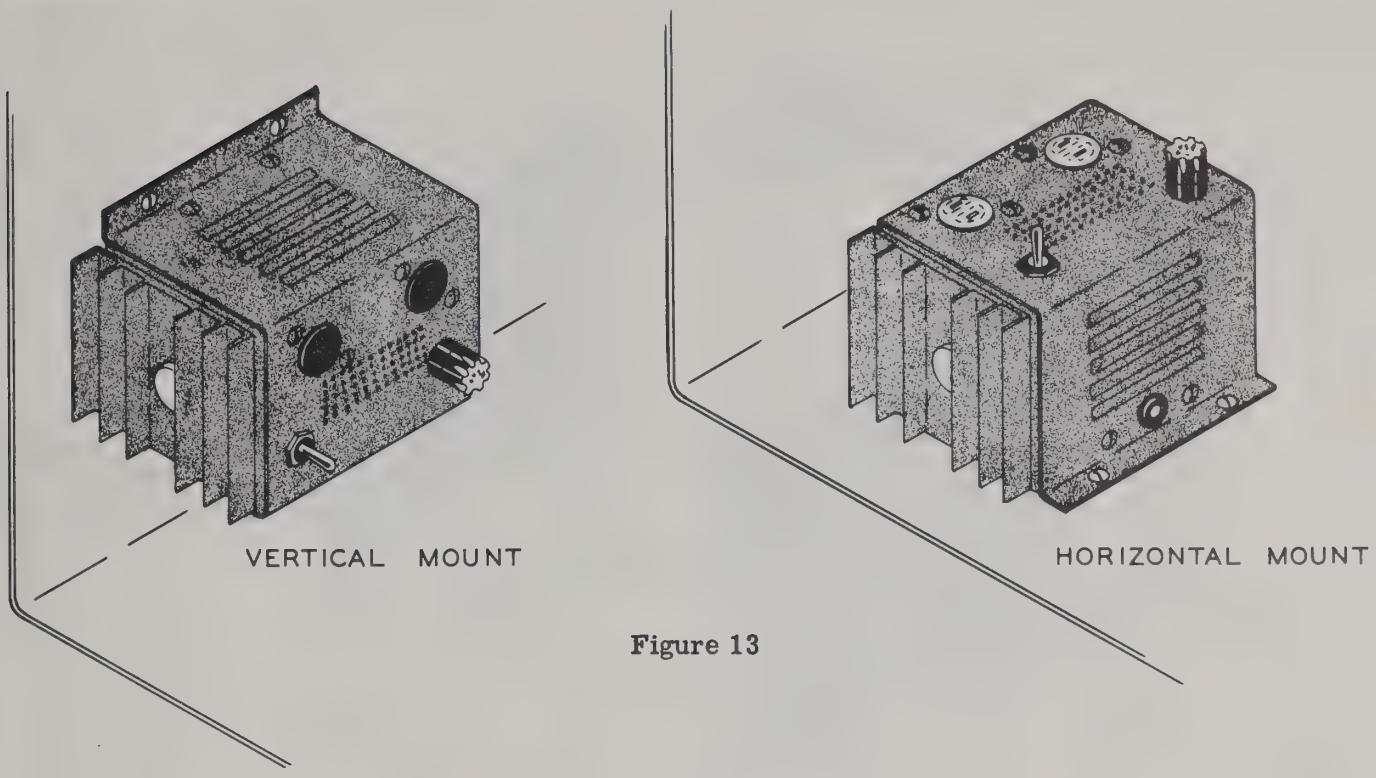


Figure 13

FINAL ASSEMBLY

In normal use, the heat sink fins of the MP-10 should always be oriented in a vertical position. Therefore, the heat sinks must be properly mounted to the insulator plates. If the MP-10 is to be wall mounted, the heat sink fins will run from front to back with respect to the chassis. If the MP-10 is to be horizontally mounted (on a table or floor), the heat sink fins will run from top to bottom (the chassis top contains the sockets, switch and fuse holder).

Refer to Figures 13 and 14 and the illustration on Page 34 for the following steps.

( ) Place one of the insulator plates in one end of the chassis. Notice the orientation of the plate when all of the mounting holes line up. Now hold a heat sink up to the insulator plate. Notice that the fins can either be horizontal or vertical since the mounting holes in the insulator plate are in a square pattern. Remove the insulator plate from the chassis.

( ) Determine the position of the MP-10 in its final installation (vertical or horizontal mounting).

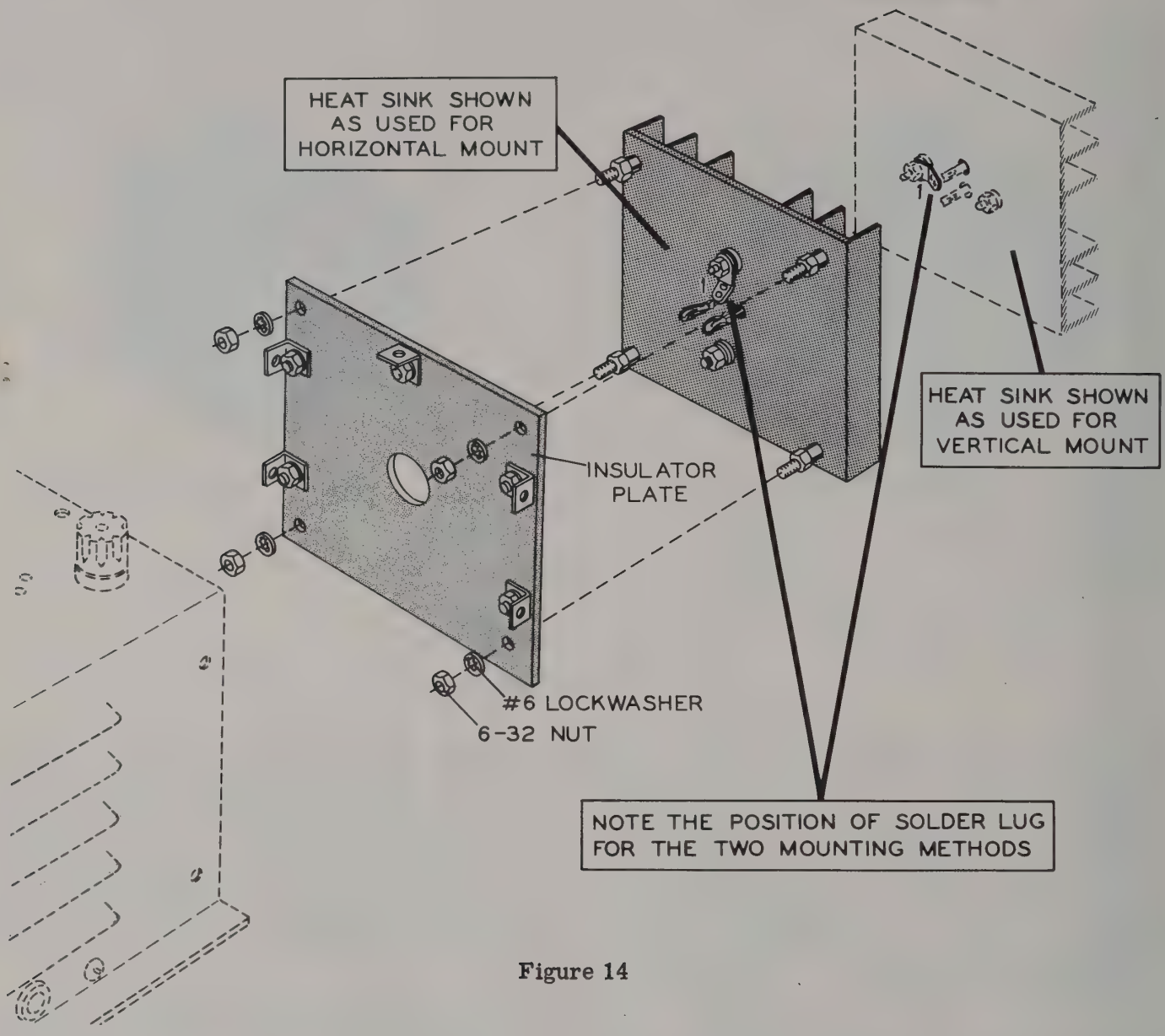


Figure 14

Refer to Figure 14 for the following steps.

(✓) Mount each heat sink assembly to an insulator plate. Use four #6 lockwashers and four 6-32 hex nuts on each assembly. Mount with the previous two steps in mind. Also, mount so that the collector terminal (lug #1) of each transistor will be above the other two terminals in the final position of the MP-10.

(✓) There are now three wires extending outward from each end of the chassis. Twist and solder the end of each wire (called tinning).

(✓) Cut four 7/8" lengths from the clear plastic sleeving.

When soldering the wires to the transistors in the next few steps, place the heat sink assembly in the approximate mounting position.

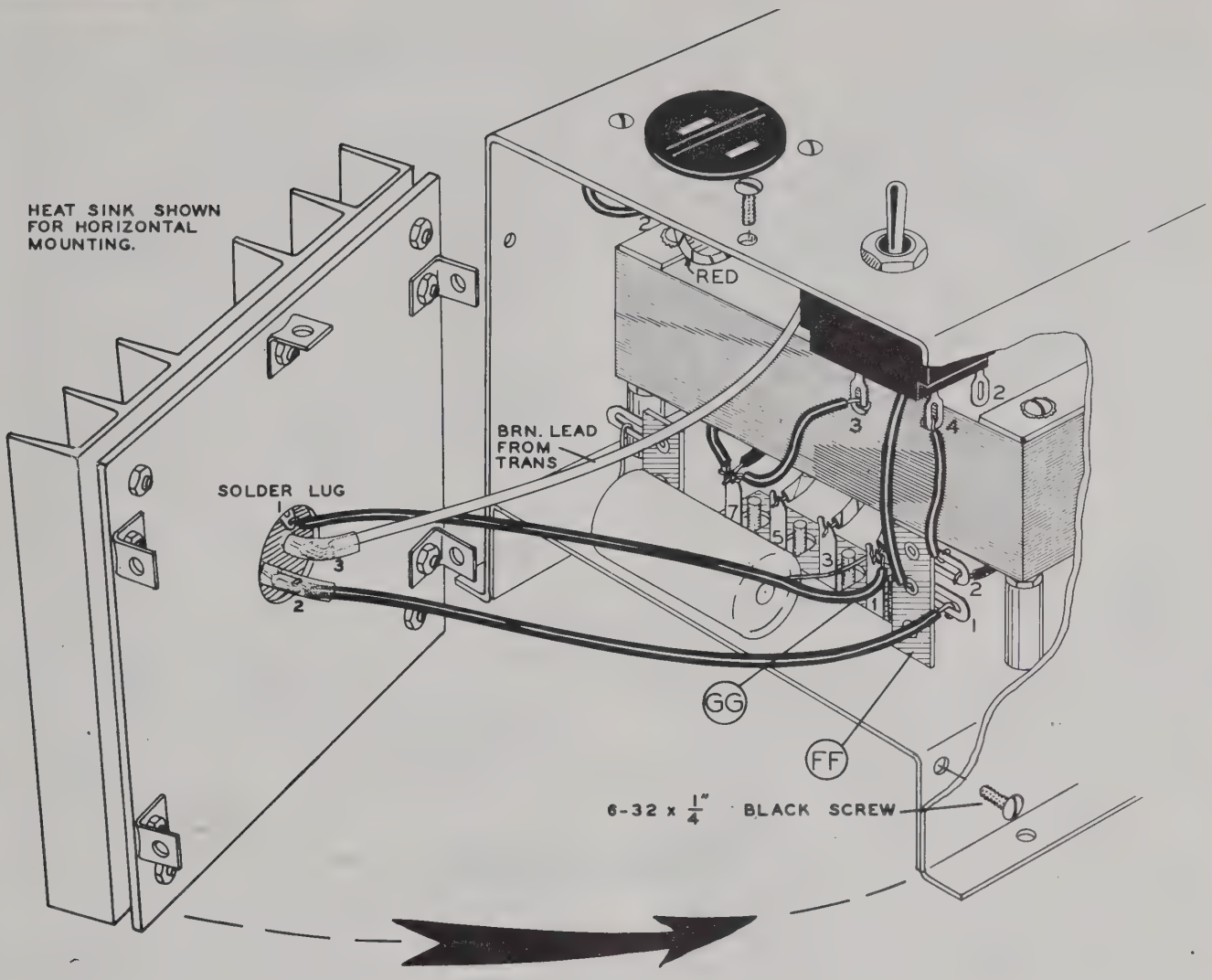


Figure 15

Refer to Figure 15 for the following steps.

(✓) Connect the wire coming from lug 1 of terminal strip GG to terminal 1 of the left transistor (S-1).

( ) Place a 7/8" length of clear plastic sleeving over the wire coming from lug 1 of terminal strip FF. Connect this wire to terminal 2 of the left transistor (S-1). After allowing the connection to cool, push the sleeving over the connection and into the hole in the heat sink. Use a probe such as a screwdriver to aid in this operation. Make sure that the sleeving goes all the way to the base of the transistor.

CAUTION: If the sleeving is not placed as directed above, the transistors may possibly be damaged.

(✓) Connect the brown wire coming from the transformer to terminal 3 of the left transistor (S-1). Use sleeving as above.

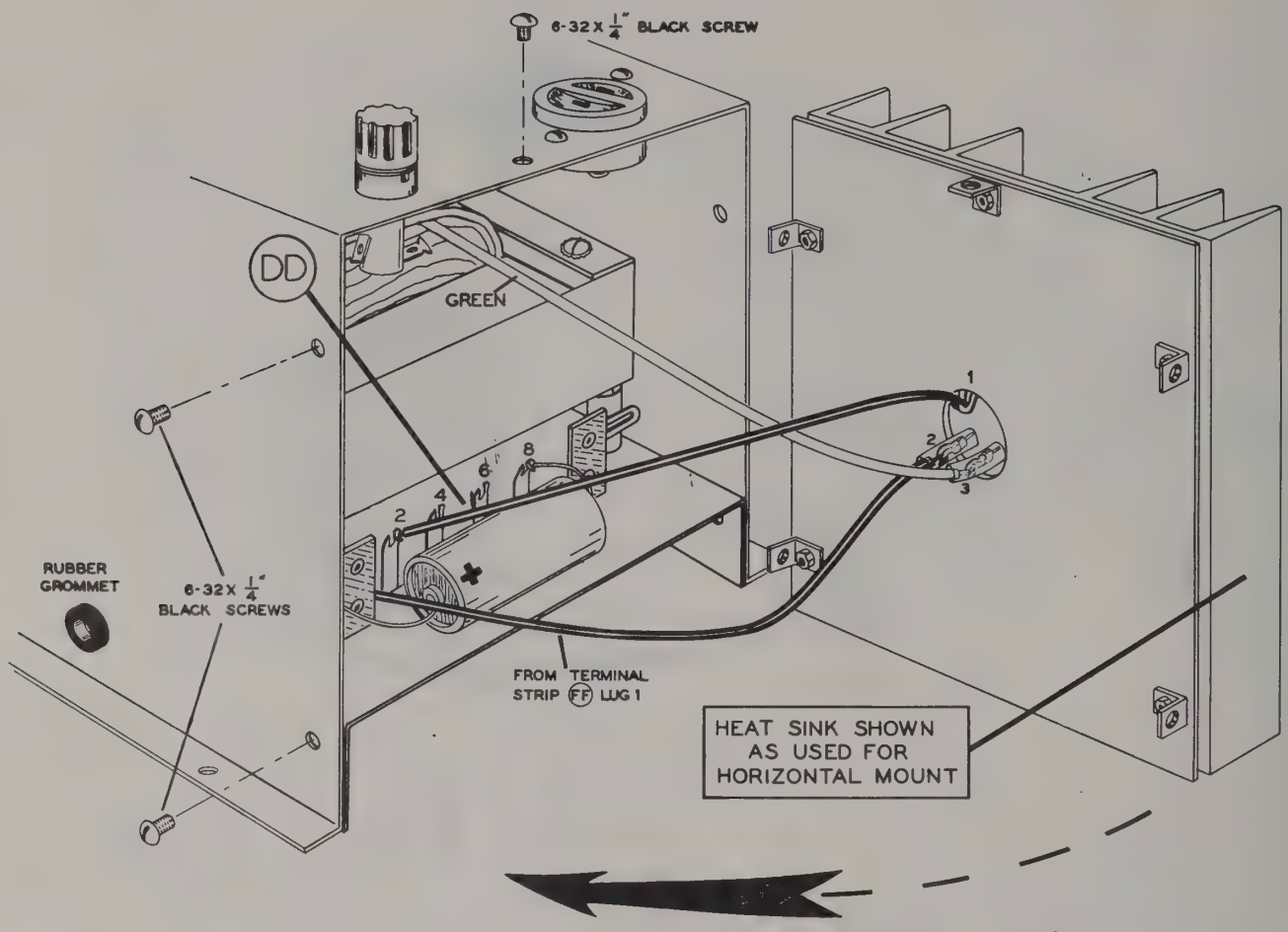


Figure 16

Refer to Figure 16 for the following steps.

( ) Connect the wire coming from lug 2 of terminal strip DD to terminal 1 of the right transistor (S-1).

( ) Connect the wire coming from lug 1 of terminal strip FF to terminal 2 of the right transistor (S-1). Use the 7/8" sleeving.

( ) Connect the green wire coming from the transformer to terminal 3 of the right transistor (S-1). Use the 7/8" sleeving.

( ) Recheck the wiring in this section.

( ) Very carefully push the left heat sink assembly into place. Adjust the wires to the transistor so that they fall into a natural position, relieving any strain on the transistor connections. WARNING: Make sure that the transistor terminals do not bend. Looking between the heat sink and the insulator plate will help to determine this.

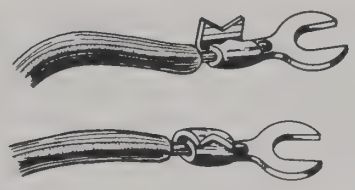
( ) Screw in the five 6-32 x 1/4" black screws that mount the heat sink assembly to the chassis. Tighten securely. See Figure 15.

( ) Repeat the two previous steps for the right heat sink assembly. See Figure 16.

( ) Place the 25 amp fuse in the fuse holder.

( ) Place the 1/2" rubber grommet in the hole at the front of the chassis. It will turn freely in the hole when properly placed. See Figure 16.

Detail 17A



Refer to Figure 17 for the following steps.

( ) Place two flat washers (3/16" ID x 1/2" OD) on each battery input stud (the terminals marked + and -).

( ) Place a wing nut on each battery input stud.

( ) Cut four 1-1/2" lengths of stranded wire and solder a #6 spade lug on each end. See Detail 17A.

( ) Fasten these jumpers to the 4-lug terminal strips (screw type) as shown in Figure 17.

This completes construction of the MP-10.

If an ohmmeter is available, the following preliminary check can be made.

( ) Set the jumpers for 12 volt operation. See Figure 19.

( ) Place the switch in the ON position.

( ) Connect the negative ohmmeter lead to the negative (-) input terminal and connect the positive ohmmeter lead to the positive (+) input terminal of the MP-10. The ohmmeter should indicate about 10 Ω.

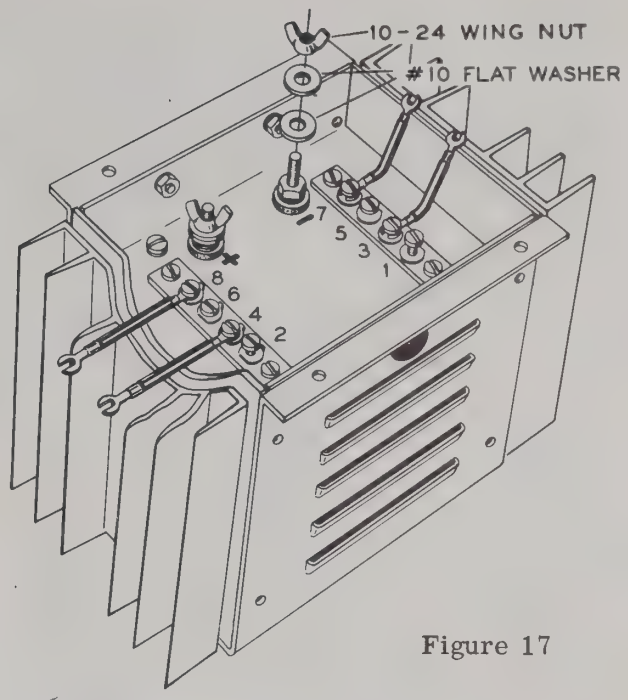


Figure 17

( ) Now, reverse the ohmmeter leads at the MP-10 input terminals. The ohmmeter should indicate about 2 Ω.

NOTE: If the ohmmeter has a positive battery ground, the readings will be reversed.

If the ohmmeter readings check with the values mentioned above, continue with installation of the MP-10. If the ohmmeter readings do not check, refer to the IN CASE OF DIFFICULTY section of this manual.

INSTALLATION INFORMATION

This section of the manual simply discusses the methods of mounting and connecting the MP-10. Read this material thoroughly, then make the actual connections and install the MP-10 as directed in the Test section of the manual, which follows.

The MP-10 should be installed in a location providing a free flow of air and protected from water spray. Remember that the "case", or "housing" of the MP-10 is well ventilated to help cool the transformer. Because of this, protect the MP-10 from the elements as much as possible. Do not mount the MP-10 in a dead air space as the air temperature may become excessively high. See the power output versus air temperature curve, Figure 20. Figure 13 on Page 21 shows two mounting positions for the MP-10. A third position might be an up-side-down mounting, such as on the ceiling; in this event the fins should be oriented as for mounting on a horizontal surface. Also see Figure 23.

For connecting the MP-10 to the battery, use #10, solid conductor copper wire. Preferably, this should be 2-conductor, plastic covered wire such as that used for home electrical wiring. The wire length between the battery and the MP-10 should not be more than ten feet. Longer battery wires or wire smaller than #10 would cause an appreciable power loss, lowering performance of the MP-10.

In installations where the MP-10 will be frequently disconnected from the battery, the method of making battery connections as shown in Figure 18 will be satisfactory. For this purpose, use the #28 drill supplied to drill holes in the center of each battery terminal. Then mount the battery studs in each terminal as shown in Figure 18.

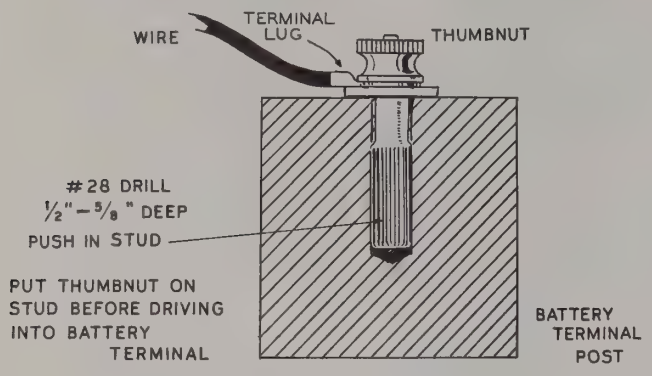


Figure 18

The four terminal lugs supplied with the kit should be attached to the battery wires as shown in Figure 18A. The terminal lugs at one end of the battery wires should be opened slightly to fit the input terminals of the MP-10.

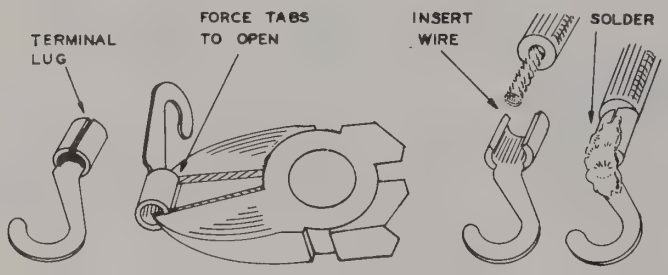
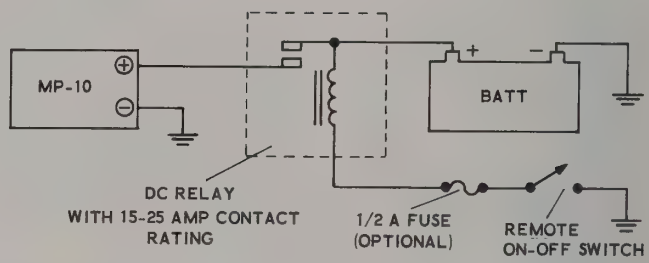


Figure 18A

For permanent installations, do not use the battery studs and terminal lugs. Instead, form small hooks at the ends of the battery wires. See Figure 18B. At the battery, the wires should be connected under the bolt or nut that secures the regular battery cable clamp. The other end of the battery wires should be connected through the rubber grommets in the side of the MP-10 to the input terminals.

Because the battery wires to the MP-10 should not be longer than ten feet, it may be desirable to turn the unit on and off remotely. The MP-10 and the necessary relay can then be mounted close to the battery. Remote switching can be accomplished using the relay circuit shown in Figure 18C. A suitable relay can be obtained locally.



NOTES:

1. ⏚ REPRESENTS COMMON GROUND CIRCUIT.
2. INTERCHANGE POLARITY OF MP-10 AND BATTERY FOR A POSITIVE-GROUND SYSTEM.
3. RELAY SHOULD BE 6 OR 12 VOLT TYPE, DEPENDING ON BATTERY VOLTAGE.

Figure 18C

Proceed with the Test section, which follows, to connect and install the MP-10.

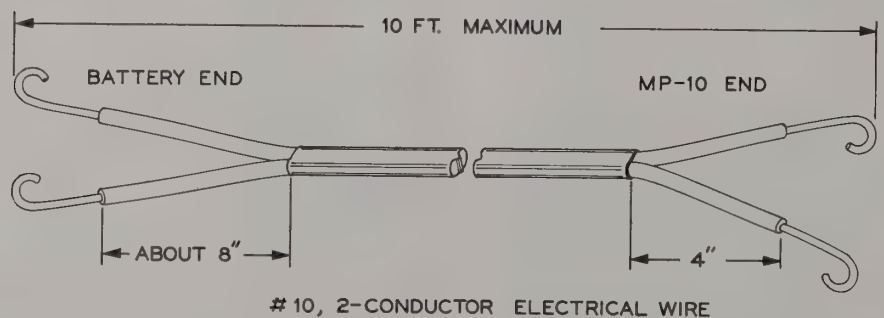


Figure 18B

TEST

CAUTION: Never reverse the polarity of the input voltage as the transistors will be permanently damaged. It is strongly recommended that each of the wires from the battery to the MP-10 be permanently tagged or otherwise marked as to polarity at the MP-10 end, to minimize the possibility of transistor damage if the wires should ever be disconnected.

Operate the MP-10 only at the proper voltage to prevent transistor damage. Never use a 12 volt storage battery with the jumpers set for 6 volt operation.

( ) Connect the short jumpers on the underside of the MP-10 as per instructions. See Figure 19.

( ) Make sure that the switch is OFF.

( ) Run the battery wires (not connected to the battery) through the 1/2" grommet of the MP-10 and connect them to the proper terminals on the underside of the unit. Watch the polarity. See Figure 19.

( ) Connect these wires from the MP-10 to the storage battery (watch polarity).

( ) Turn the MP-10 ON. A buzzing sound should be heard. Push the switch to the START position. The buzz should change pitch slightly. If the MP-10 is not working, refer to the IN CASE OF DIFFICULTY section.

WARNING: Never leave the MP-10 on if it fails to start or run. The transistors may become excessively hot and destroy themselves.

( ) If the performance is OK in the above step, turn the unit off and plug a 100 watt (or less) light bulb into one of the 117 volt, 60 cps sockets. Turn the MP-10 back on. The lamp should light (for 6 volt operation, push the switch to START until the lamp lights). If the MP-10 will not start after a few seconds, turn the unit off and refer to the IN CASE OF DIFFICULTY section.

( ) Turn the unit off. The MP-10 may now be installed in its final position. Use the four #8 x 7/8" sheet metal screws. The #28 drill bit may be used to provide "starting" holes for the mounting screws, if necessary.

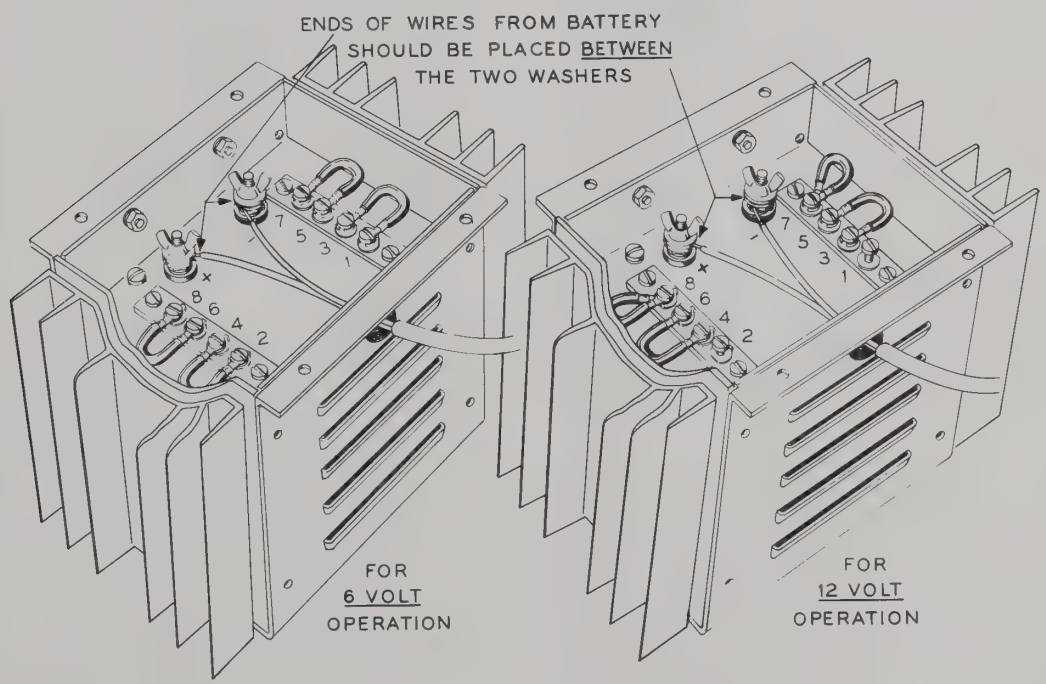


Figure 19

OPERATION

6 AND 12 VOLT OPERATION

The MP-10 DC to AC Power Converter can be operated from a 6 volt storage battery or from a 12 volt storage battery. The output voltage waveform is the same in magnitude and frequency in either case. However, the MP-10 is capable of delivering twice as much output power from a 12 volt source as from a 6 volt source.

The reason for this is that the MP-10 will take up to 25 amperes of input current in either 6 or 12 volt operation; however, since power equals current times voltage, 12 volt operation will provide twice as much power as 6 volt operation.

It should also be noted that for 12 volt operation there is a maximum power rating as well as a continuous power rating. The reason for this is that the transformer will not continuously handle 25 amperes of current. Excessive heating will result and the transformer may be damaged if this continues too long. If the MP-10 is started "cold" at 77 degrees Fahrenheit, it can deliver up to 240 watts output continuously for approximately 25 minutes, at which time the load should be reduced to the continuous rating as determined from Figure 20.

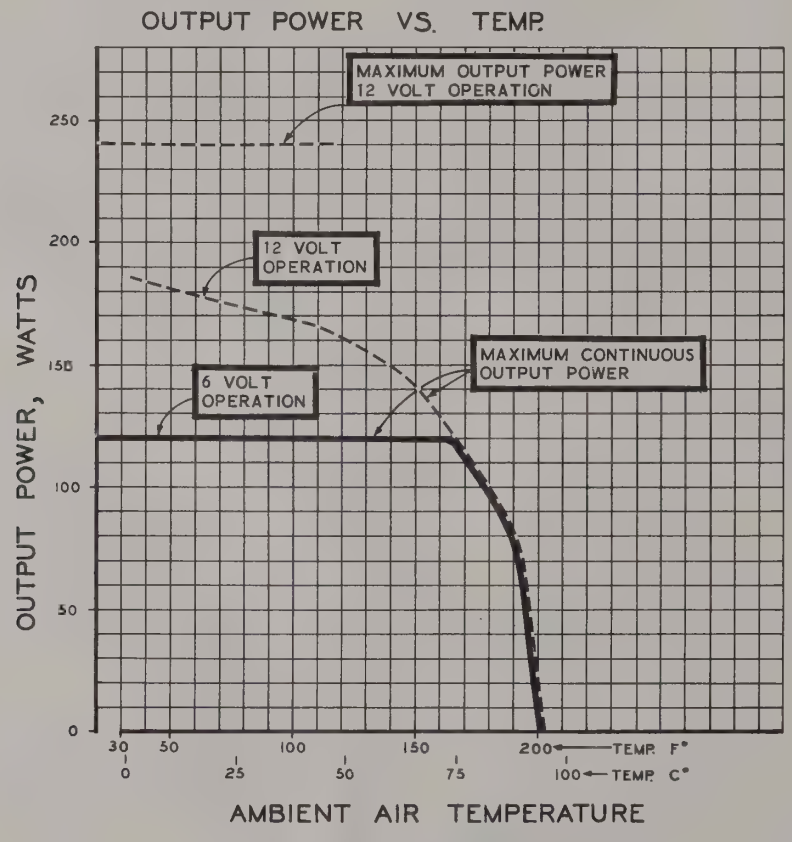


Figure 20

In 6 volt operation, the MP-10 can handle the full 25 ampere input current since the primary windings are parallel connected. This means that each primary winding carries 12-1/2 amperes for half of a cycle instead of 25 amperes continuously. In short, for the same input current, the primary windings dissipate four times as much power in the 12 volt mode as in the 6 volt mode.

OUTPUT POWER, COOLING, EFFICIENCY, STARTING

Figure 20 is provided as a guide to determine safe loads for the MP-10. It is only a guide and it does not mean that the MP-10 owner must use thermometers and watt meters to determine his exact operating point. It must be understood that the MP-10 has internal heat losses and that this heat must be given off to the surrounding air so that electrical components in the unit do not attain temperatures above their ratings and "burn up."

If the air around the MP-10 is warm, the continuous output power must be reduced, thus reducing the internal heat losses. The warm air can then adequately cool the MP-10 and keep the component temperature at a safe level. For example, the transformer is rated at 130 degrees Centigrade (266 degrees Fahrenheit). The internal parts of the transistors can operate up to 95 degrees C (203 degrees F). At room temperatures, the transformer will be the limiting component. At higher temperatures, say 50 degrees C (122 degrees F), the transistors will limit the output power of the MP-10. It should be stated that the MP-10 will become very hot to the touch when it is operating under maximum continuous output power. This is normal.

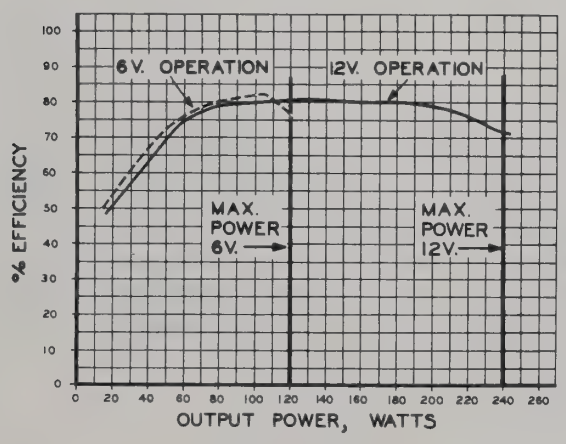


Figure 21

Figure 21 gives typical conversion (DC to AC) efficiencies for the MP-10. A constant input voltage is assumed; although this may be difficult to obtain in practice, it is the only way that a chart of this nature can have any meaning.

The START position on the switch need only be used when the MP-10 is operating in a 6 volt system. Its purpose is to start the MP-10 if it fails to start when the switch is thrown to ON. This will probably be necessary only when incandescent lamps are being used. The reason for this is that lamps have a very low resistance when they are cold and act as a momentary overload to the MP-10 until they become lighted. The START position places an extra resistor in the circuit to facilitate starting. If the MP-10 is being operated from a 6 volt source, always use the switch on the MP-10 to turn lamps on and off. The reason for this is the starting problem as discussed above. This is not critical in 12 volt operation. The warning is again repeated that if the MP-10 fails to start after several seconds, turn the unit OFF to prevent possible damage to the transistors.

Before attempting to operate any equipment powered by the MP-10 , check its wattage requirement. The nameplate will usually give a power requirement in watts. Sometimes the current is specified. To find the approximate power required, multiply the current times the voltage (120 volts). If this product is within the rating of the MP-10, it is alright to operate the unit.

OUTPUT VOLTAGE

The output voltage waveform of the MP-10 also needs some explanation. It has a different shape than that of standard home power systems but it will do essentially the same job. The MP-10 has an essentially square waveform whereas the home usually has a sine waveform.

In Figure 22 notice the difference between the two waveforms that have identical rms values (117 volts). The rms value of a waveform is equal to the DC value required to produce an equal amount of heat in the same resistance. In the case above, the two waveforms will produce the same amount of heat in the same resistance. Usually, the most important factor of a waveform is its rms value. But occasionally, the frequency and peak values are also important. For example,

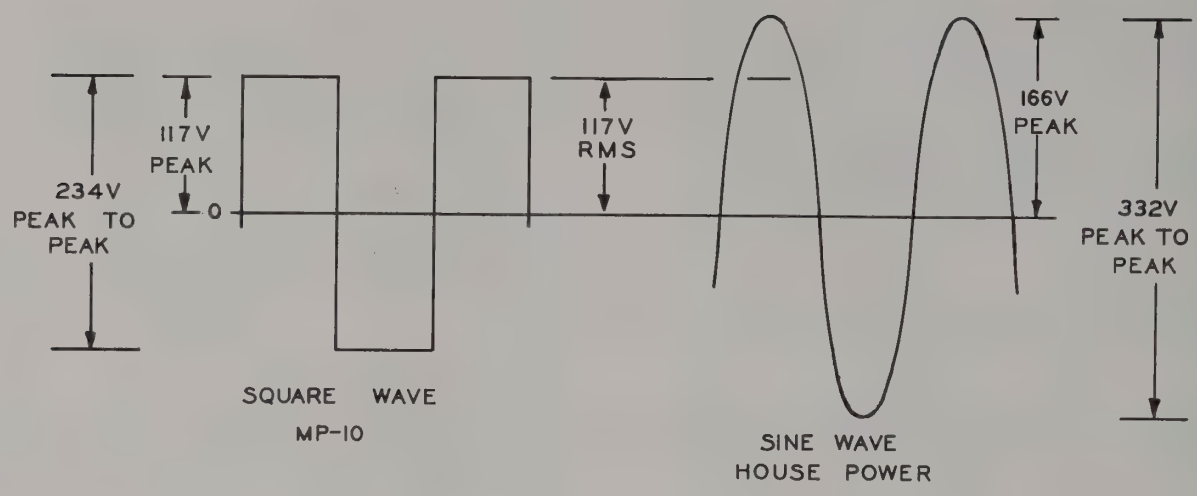


Figure 22

a radio designed for home use derives its tube voltage from the peak value of the sine wave. An equivalent rms square wave powering the same radio will produce somewhat lower tube voltages. The radio will operate adequately from the square wave but will probably require a slightly higher volume control setting. Other similar types of equipment will also operate adequately when powered from a square wave but may also require different control settings.

EQUIPMENT POWERED BY MP-10

It is possible that some equipment, when powered by the MP-10, will exhibit seemingly peculiar characteristics. Following are some typical examples and possible remedies if the effect is not tolerable.

Radio receivers, audio amplifiers and other equipment using a speaker or headphone to produce sound may have a slight 120 cycle buzz. This is caused by the steep slopes of the square wave. The buzz can enter the equipment through its own power supply. It might also enter through the filament wiring for the tubes but this is less likely. If the power supply in the equipment is in good working order, the buzz will probably not be injected at this point. The most likely place is in the switch circuit. The switch is usually associated with the volume control, where a small amount of energy is radiated from the switch to the volume control, thus injecting the 120 cycle buzz into the audio circuit. A possible cure is to place a 1 or 2 μfd, 200 volt capacitor directly across the output of the MP-10. This reduces the slope of the square wave but the converter may run slightly hotter.

The frequency of the MP-10 may not be exactly 60 cps since the frequency is directly proportional to the input voltage. Also frequency will change slightly with the load on the MP-10. Motor speed is not critical for most applications. However, record players and tape recorders require a fairly critical speed. Some motors have a speed control. For those that do not, a little experimentation with the battery voltage should provide satisfactory operation. If the voltage is high (motor running too fast) a series dropping resistor in the battery wires may help. For example, if the voltage is 1 volt too high, and the current is 5 amps, a 0.2 Ω 7 watt resistor would drop the voltage to produce a good motor speed. Usually this problem is not serious enough to warrant extensive experimentation to obtain acceptable Hi-Fi performance.

OPERATION OF TWO OR MORE MP-10'S

Two or more MP-10 Converters may be connected in parallel, giving any desired output power. Always observe the proper DC input polarity. It does not make any difference how the outputs are connected in parallel but it is probably best to follow a logical pattern. The MP-10's will adjust themselves as to output voltage, frequency and power.

The MP-10 cannot be used backwards to charge a battery. The DC current will not reverse and possible transistor damage will result.

Always turn the MP-10 off when it is not in use as it will consume about 18 watts with no load. This will save unnecessary drain on the battery.

IN CASE OF DIFFICULTY

General:

1. Recheck the wiring. Trace each lead in colored pencil on the pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the constructor.

2. It is interesting to note that about 90% of the kits that are returned for repair are defective due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as illustrated in the Figures found in SOLDERING TECHNIQUES section of this manual.

3. Check the values of the component parts. Be sure that the proper part has been wired into the circuit, as shown in the pictorial diagram and as called out in the wiring instructions.

4. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring beneath the chassis.

5. A review of the CIRCUIT DESCRIPTION, TEST, OPERATION, and block diagrams will prove helpful in indicating where to look for trouble.

Specific:

DIFFICULTY	POSSIBLE CAUSE
MP-10 will not operate.	Wrong battery polarity. Faulty wires and connections to battery. Blown Fuse.
Fuses blow.	Wiring error. One or both transistors shorted. Wrong battery polarity.
MP-10 will not operate under rated load.	Low battery voltage. Faulty input connections and wire. Wattage requirements of load too high.
One or both transistors running extremely hot.	Poor ventilation. Bad transistor. Load too heavy.
Low or high ohmmeter readings from Page 25.	Shorted transistor. Poor solder connections. Wiring error. Solder lugs at AA and BB shorted to transformer spacers. Faulty fuse.

SERVICE INFORMATION

SERVICE

If, after applying the information contained in this manual and your best efforts, you are still unable to obtain proper performance, it is suggested that you take advantage of the technical facilities which the Heath Company makes available to its customers.

The Technical Consultation Department is maintained for your benefit. This service is available to you at no charge. Its primary purpose is to provide assistance for those who encounter difficulty in the construction, operation or maintenance of HEATHKIT® equipment. It is not intended, and is not equipped to function as a general source of technical information involving kit modifications nor anything other than the normal and specified performance of HEATHKIT® equipment.

Although the Technical Consultants are familiar with all details of this kit, the effectiveness of their advice will depend entirely upon the amount and the accuracy of the information furnished by you. In a sense, YOU MUST QUALIFY for GOOD technical advice by helping the consultants to help you. Please use this outline:

1. Before writing, fully investigate each of the hints and suggestions listed in this manual under "IN CASE OF DIFFICULTY." Possibly it will not be necessary to write.

2. When writing, clearly describe the nature of the trouble and mention all associated equipment. Specifically report operating procedures, switch positions, connections to other units and anything else that might help to isolate the cause of trouble.

3. Report fully on the results obtained when testing the unit initially and when following the suggestions under "IN CASE OF DIFFICULTY." Be as specific as possible and include voltage readings if test equipment is available.

4. Identify the kit model number and date of purchase, if available.

5. Print or type your name and address, preferably in two places on the letter.

With the preceding information, the consultant will know exactly what kit you have, what you would like it to do for you and the difficulty you wish to correct. The date of purchase tells him whether or not engineering changes have been made since it was shipped to you. He will know what you have done in an effort to locate the cause of trouble and, thereby, avoid repetitious suggestions. In short, he will devote full time to the problem at hand, and through his familiarity with the kit, plus your accurate report, he will be able to give you a complete and helpful answer. If replacement parts are required, they will be shipped to you, subject to the terms of the Warranty.

The Factory Service facilities are also available to you, in case you are not familiar enough with electronics to provide our consultants with sufficient information on which to base a diagnosis of your difficulty, or in the event that you prefer to have the difficulty corrected in this manner. You may return the completed instrument to the Heath Company for inspection and necessary repairs and adjustments. You will be charged a minimal service fee, plus the price of any additional parts or material required. However, if the completed kit is returned within the Warranty period, parts charges will be governed by the terms of the Warranty. State the date of purchase, if possible.

Local Service by authorized HEATHKIT® Service Centers is also available and often will be your fastest, most efficient method of obtaining service for your HEATHKIT® equipment. Although you may find charges for local service somewhat higher than for factory service, the amount of increase is usually offset by the transportation charge you would pay if you elected to return your kit to the Heath Company.

HEATHKIT® Service Centers will honor the regular 90 day HEATHKIT® Parts Warranty on all kits, whether purchased through a dealer or directly from Heath Company; however, it will be necessary that you verify the purchase date of your kit.

Under the conditions specified in the Warranty, replacement parts are supplied without charge; however, if the Service Center assists you in locating a defective part (or parts) in your kit, or installs a replacement part for you, you may be charged for this service.

HEATHKIT® equipment purchased locally and returned to Heath Company for service must be accompanied by your copy of the dated sales receipt from your authorized HEATHKIT® dealer in order to be eligible for parts replacement under the terms of the Warranty.

THIS SERVICE POLICY APPLIES ONLY TO COMPLETED EQUIPMENT CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Equipment that has been modified in design will not be accepted for repair. If there is evidence of acid core solder or paste fluxes, the equipment will be returned NOT repaired.

For information regarding modification of HEATHKIT® equipment for special applications, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at most electronic equipment stores. Although the Heath Company sincerely welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for special purposes. Therefore, such modifications must be made at the discretion of the kit builder, using information available from sources other than the Heath Company.

REPLACEMENTS

Material supplied with HEATHKIT® products has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally improper instrument operation can be traced to a faulty component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information.

A. Thoroughly identify the part in question by using the part number and description found in the manual Parts List.

B. Identify the type and model number of kit in which it is used.

C. Mention date of purchase.

D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. PLEASE DO NOT RETURN THE ORIGINAL COMPONENT UNTIL SPECIFICALLY REQUESTED TO DO SO. Do not dismantle the component in question as this will void the guarantee. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

SHIPPING INSTRUCTIONS

In the event that your instrument must be returned for service, these instructions should be carefully followed.

ATTACH A TAG TO THE EQUIPMENT BEARING YOUR NAME, COMPLETE ADDRESS, DATE OF PURCHASE, AND A BRIEF DESCRIPTION OF THE DIFFICULTY ENCOUNTERED. Wrap the equipment in heavy paper, exercising care to prevent damage. Place the wrapped equipment in a stout carton of such size that at least three inches of shredded paper, excelsior, or other resilient packing material can be placed between all sides of the wrapped equipment and the carton. Close and seal the carton with gummed paper tape, or alternately, tie securely with stout cord. Clearly print the address on the carton as follows:

To: HEATH COMPANY
Benton Harbor, Michigan

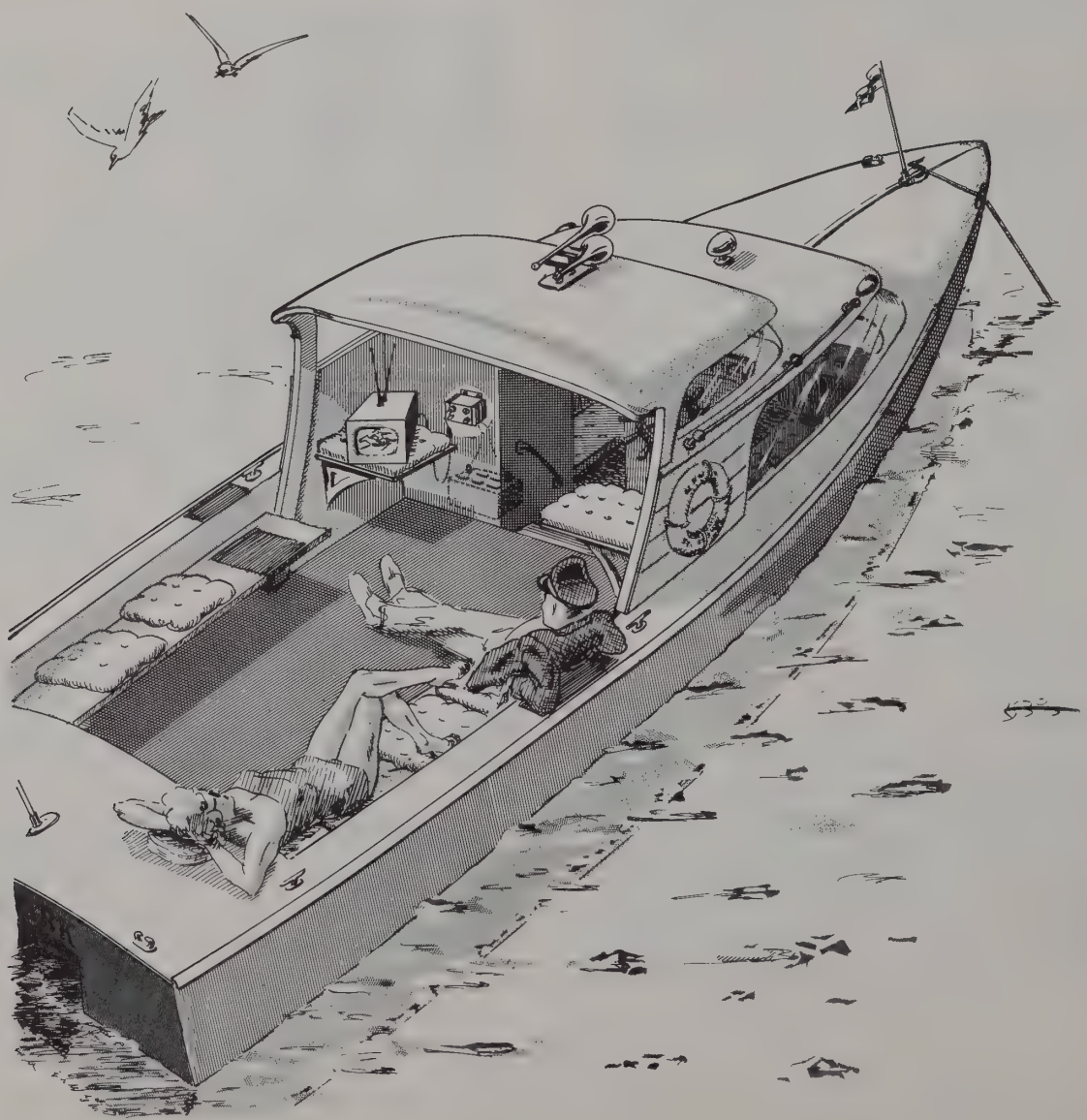
Include your name and return address on the outside of the carton. Preferably affix one or more "Fragile" or "Handle With Care" labels to the carton, or otherwise so mark with a crayon of bright color. Ship by parcel post or prepaid express; note that a carrier cannot be held responsible for damage in transit if, in HIS OPINION, the article is inadequately packed for shipment.

WARRANTY

Heath Company warrants that for a period of three months from the date of shipment, all Heathkit parts shall be free of defects in materials and workmanship under normal use and service and that in fulfillment of any breach of such warranty, Heath Company shall replace such defective parts upon the return of the same to its factory. The foregoing warranty shall apply only to the original buyer, and is and shall be in lieu of all other warranties, whether express or implied and of all other obligations or liabilities on the part of Heath Company and in no event shall Heath Company be liable for any anticipated profits, consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase, assembly or operation of Heathkits or components thereof. No replacement shall be made of parts damaged by the buyer in the course of handling or assembling Heathkit equipment.

NOTE: The foregoing warranty is completely void and we will not replace, repair or service instruments or parts thereof in which acid core solder or paste fluxes have been used.

HEATH COMPANY



HELPFUL KIT BUILDING INFORMATION

Before attempting actual kit construction read the construction manual through thoroughly to familiarize yourself with the general procedure. Note the relative location of pictorials and pictorial inserts in respect to the progress of the assembly procedure outlined.

This information is offered primarily for the convenience of novice kit builders and will be of definite assistance to those lacking thorough knowledge of good construction practices. Even the advanced electronics enthusiast may benefit by a brief review of this material before proceeding with kit construction. In the majority of cases, failure to observe basic instruction fundamentals is responsible for inability to obtain desired level of performance.

RECOMMENDED TOOLS

The successful construction of Heathkits does not require the use of specialized equipment and only basic tools are required. A good quality electric soldering iron is essential. The preferred size would be a 100 watt iron with a small tip. The use of long nose pliers and diagonal or side cutting pliers is recommended. A small screw driver will prove adequate and several additional assorted screw drivers will be helpful. Be sure to obtain a good supply of rosin core type radio solder. Never use separate fluxes, paste or acid solder in electronic work.

ASSEMBLY

In the actual mechanical assembly of components to the chassis and panel, it is important that the procedure shown in the manual be carefully followed. Make sure that tube sockets are properly mounted in respect to keyway or pin numbering location. The same applies to transformer mountings so that the correct transformer color coded wires will be available at the proper chassis opening.

Make it a standard practice to use lock washers under all 6-32 and 8-32 nuts. The only exception being in the use of solder lugs—the necessary locking feature is already incorporated in the design of the solder lugs. A control lock washer should always be used between the control and the chassis to prevent undesirable rotation in the panel. To improve instrument appearance and to prevent possible panel marring use a control flat nickel washer under each control nut.

When installing binding posts that require the use of fiber insulating washers, it is good practice to slip the shoulder washer over the binding post mounting stud before installing the mounting stud in the panel hole provided. Next, install a flat fiber washer and a solder lug under the mounting nut. Be sure that the shoulder washer is properly centered in the panel to prevent possible shorting of the binding post.

WIRING

When following wiring procedure make the leads as short and direct as possible. In filament wiring requiring the use of a twisted pair of wires allow sufficient slack in the wiring that will permit the twisted pair to be pushed against the chassis as closely as possible thereby affording relative isolation from adjacent parts and wiring.

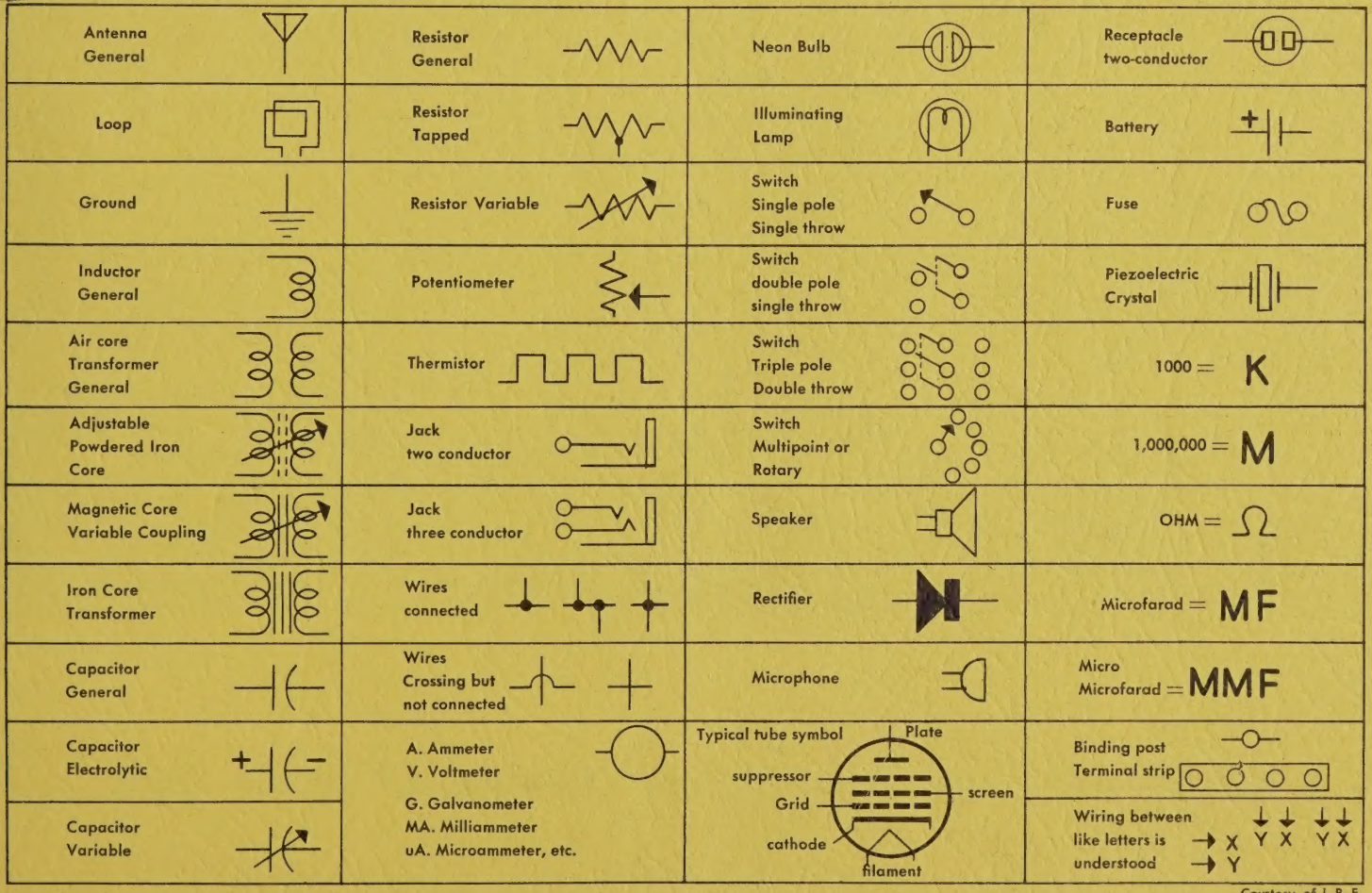
When removing insulation from the end of hookup wire, it is seldom necessary to expose more than a quarter inch of the wire. Excessive insulation removal may cause a short circuit condition in respect to nearby wiring or terminals. In some instances, transformer leads of solid copper will have a brown baked enamel coating. After the transformer leads have been trimmed to a suitable length, it is necessary to scrape the enamel coating in order to expose the bright copper wire before making a terminal or soldered connection.

In mounting parts such as resistors or condensers, trim off all excess lead lengths so that the parts may be installed in a direct point-to-point manner. When necessary use spaghetti or insulated sleeving over exposed wires that might short to nearby wiring.

It is urgently recommended that the wiring dress and parts layout as shown in the construction manual be faithfully followed. In every instance, the desirability of this arrangement was carefully determined through the construction of a series of laboratory models.

SOLDERING

Much of the performance of the kit instrument, particularly in respect to accuracy and stability, depends upon the degree of workmanship used in making soldered connections. Proper soldered connections are not at all difficult to make but it would be advisable to observe a few precautions. First of all before a connection is to be soldered, the connection itself should be clean and mechanically strong. Do not depend on solder alone to hold a connection together. The tip of the soldering iron should be bright, clean and free of excess solder. Use enough heat to thoroughly flow the solder smoothly into the joint. Avoid excessive use of solder and do not allow a flux flooding condition to occur which could conceivably cause a leakage path between adjacent terminals on switch assemblies and tube sockets. This is particularly important in instruments such as the VTVM, oscilloscope and generator kits. Excessive heat will also burn or damage the insulating material used in the manufacture of switch assemblies. Be sure to use only good quality rosin core radio type solder.



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